

Guide to Personal Computing



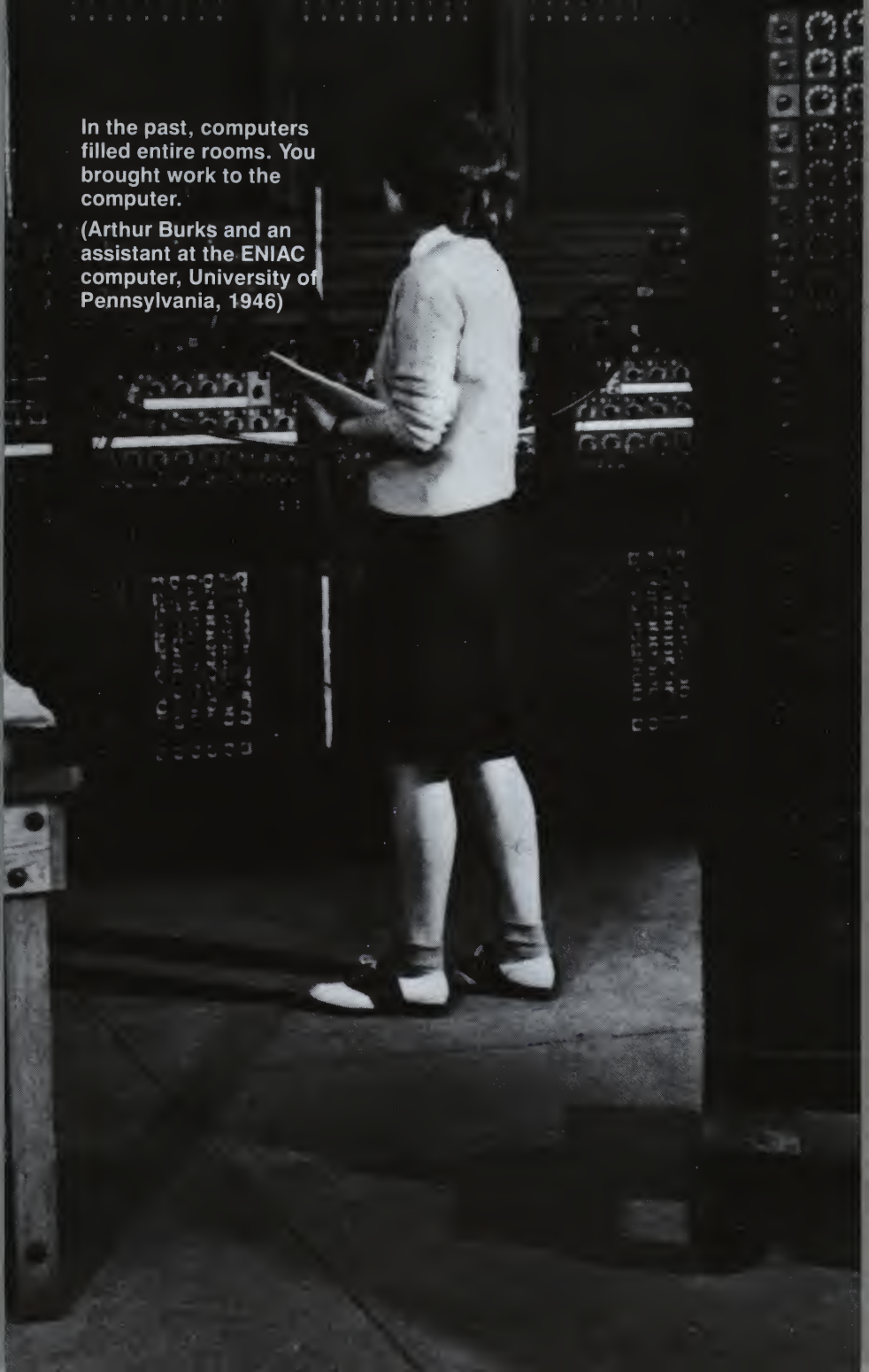


Guide to Personal Computing



In the past, computers filled entire rooms. You brought work to the computer.

(Arthur Burks and an assistant at the ENIAC computer, University of Pennsylvania, 1946)





**Today, personal computers
can sit right on your desk
or wherever you work.
(DIGITAL's Personal
Computer)**



Preface

In 1957, when DIGITAL was founded, computers were very large, delicate and extremely expensive machines. These early mainframe computers had entire rooms to themselves and whole departments for maintenance and service. The cost of the computer itself was always over a million dollars and the number of support personnel that was required restricted this type of computing to very large companies. People would bring work to the computer room and leave it. Later they returned to see if the computer had successfully processed the information. If it had failed they would have to take the failure data, analyze it, revise their program, and then go through the process again. This kind of environment—batch environment—still exists. It is effective where large quantities of information need to be processed in the same way, but it is not flexible enough for many of today's computing needs.

Today, computers don't have to be separated from the people who need the information. A personal computer can sit right on your desk. Personal computers are small, relatively low-priced and easy to use. You don't need to know a special computer programming language to do productive work. You don't have to worry about making serious errors such as erasing valuable information. The computer interacts with you, step-by-step, as you perform your job. These new personal computers can contain as much computing power as the huge isolated computers of years ago.

The world of personal computing is rapidly expanding to include most businesses and almost every profession. Personal computers give a real advantage to people whose jobs are planning, decision making, or organizing the vital records for a business. As even more people adopt the personal computer as a business tool, they develop new ideas and new innovative ways to use computers. Today, a business-person who is not planning to use some form of personal computing is in danger of falling behind the competition.

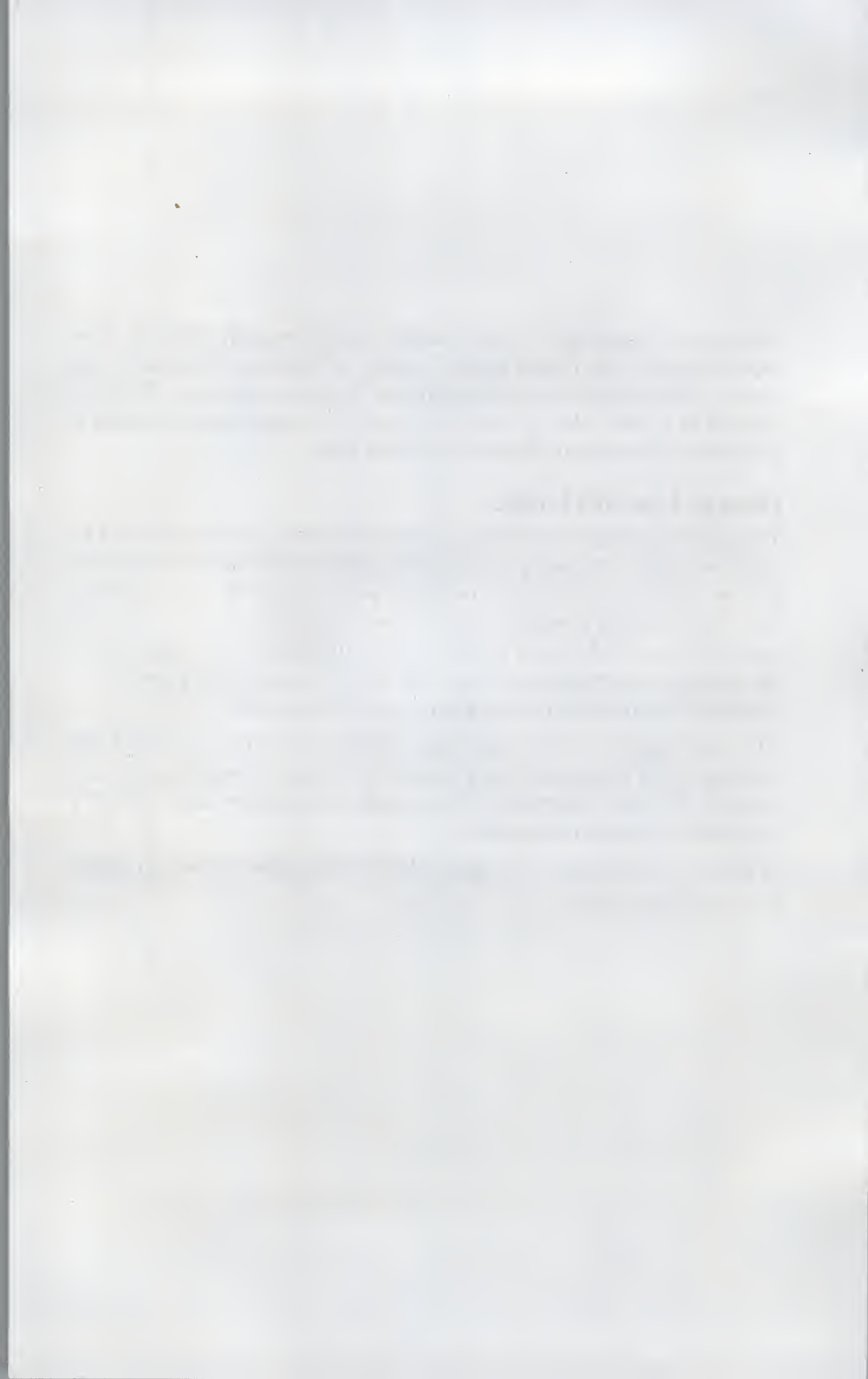
All personal computers on the market are not equally effective. The capabilities of the home/hobby variety of personal computer are quickly exhausted in a professional or business situation. What is needed is a clear idea of which features and characteristics make a personal computer capable of productive work.

How to Use this Guide

This guide is designed to help you select the features you will need to make personal computing a productive part of your business. It doesn't assume that you have any experience with computers yet, not even with the currently-popular variety of personal computers. It will take you right from the basics of personal computing up to a new generation of personal computers that are capable of putting the power of a complete business computer system right on your desk.

The information on the guide gets progressively more detailed. By starting at the beginning and proceeding through the guide, you can acquire all the information you need to compare and select a top-quality personal computer.

A glossary in the back of the guide defines computer terms that might be unfamiliar to you.



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Chapter 1—What Can a Personal Computer Do for Me?

This chapter shows how to use personal computers to their full advantage in business. It gives examples, in the form of short scenarios, from different areas of day-to-day work, so you can see where the personal computer fits in.

Chapter 2—What Do I Need to Know about Personal Computers?

This straightforward explanation of personal computers describes how they work and defines many of the technical terms that are used in personal computing. It also explains the usefulness of different personal computer features.

Chapter 3—DIGITAL's Personal Computers

The first half of this chapter introduces the personal computers from Digital Equipment Corporation—the Rainbow 100, DECmate II, and the Professional 325 and Professional 350. It gives you an overview of their hardware, software specialization and the options you can add to your system.

The second half of the chapter goes into detail about the elements that are common to all of DIGITAL's personal computers—the keyboard, video display, and the system unit—and provides technical specifications. A final section is devoted to three of DIGITAL's printers—the LA50 Personal Printer, Letterprinter 100, and the LQP02 Letter-Quality Printer—which can be used with every DIGITAL personal computer.

Chapter 4—The Rainbow 100

The Rainbow 100 personal computer is designed to run a great variety of popular 8-bit and 16-bit application programs. The chapter described this versatile computer's hardware, the options that can be added to the system and some of the productive applications software that is available.

Chapter 5 — The Professional 325 and the Professional 350

The Professional 325 and the Professional 350 are DIGITAL's most advanced personal computers. They feature a multi-tasking operating system and advanced communications capabilities. The chapter describes the basic Professional 325 and Professional 350 systems and the advanced options that are available—including a telephone management system and an extended bit-map option. It also gives a detailed description of the operating system environment that makes these advanced personal computers so easy to use.

Chapter 6 — Service and Support

Service and support are vital to the success of personal computers in any business. This chapter details the ongoing service and support that is available worldwide for users of DIGITAL's personal computers.

Chapter 7 — Digital Equipment Corporation

Your personal computer will reflect many of the qualities of the company that makes it. At Digital Equipment Corporation we are proud of our 25 years of experience building interactive computers. This chapter gives a brief history of personal computing from the time the computer left the computer room to the present and describes Digital Equipment Corporation. The quality of the computer products we make and the continuing support we provide customers have made us the leading minicomputer manufacturer in the world.

Appendix

- The professional Developer's Toolkit
- Professional Realtime Interface Module

Glossary

The glossary contains the definitions for many computer terms.



Chapter 1

What Can a Personal Computer Do for Me?

Introduction

The first thing you may notice about a personal computer is the way it can get you or your business out of the paper jungle. Every business needs to maintain information on standard forms. The irony is that the more successful you become, the more the paper piles up. Computers are experts at creating necessary forms, storing forms, and searching through stacks of forms for just the information you need.

In a business setting, not all personal computers are equally adept. Personal computers with limited capabilities are quickly exhausted by the volume of information a business needs access to or by the size and complexity of the calculations that are required to do productive work. There are two further keys to the continued usefulness of a business computer: its ability to work with other computers and the ability to upgrade the system as the business grows.

DIGITAL has introduced a whole new generation of personal computers designed to meet the needs of businesses and professionals. They have the computing power, storage capacity, and communications capabilities to improve your productivity. The stories in this chapter introduce some of the key benefits of our new generation of personal computers.

How Long Will It Take to Start Doing Productive Work?

There is no concise answer to the question of how much time is needed to bring the capabilities of a personal computer into your business or profession. It depends upon three factors:

Becoming familiar with your computer - You need to set aside the time to learn how to use your personal computer. This process doesn't have to be tedious or take a long time. In fact, it can be enjoyable. The manufacturer's documentation and computer-based instruction, if available, can be a big help at this stage.

Becoming familiar with the application software - Next, you need to become familiar with the software that is going to do the job. The computer lends itself to experimentation, but this is not the most efficient way to learn about programs. Good documentation that can take you through a program step-by-step and show you all its nuances can save you weeks of trial and error. Good computer-based instruction for applications software can save even more time.

The size and complexity of the job - Finally, you need to enter your records or information into the computer. The first time through, this information needs to be typed in and then checked to be sure it was entered correctly. The time that this takes depends on the size of the job. Once it is in the computer it can be manipulated quickly. It doesn't take long to start doing real forecasting with a spreadsheet program once you are familiar with the software. But if you are planning to run your entire accounting and inventory system on the computer, the data entry and checking phase will take longer.

The remainder of this chapter is devoted to examples of what personal computers can do for you once you have everything set up. These stories give concrete examples of how personal computers can be used for:

- **Increased Productivity for Independent Professionals**

Roger, a chartered accountant, prepares tax returns and analyzes investments.

- **Improving Secretarial Efficiency**

Sheila, a secretary for eight people, is able to improve her secretarial efficiency with professional word processing.

- **Improving Management Decisions and Efficiency**

Paul, a research manager, improves his ability to make management decisions with forecasting programs that allow him to manage information - not react to it.

- **Managing the Information Flow**

Len, an executive for a large company, distributes information through computer-to-computer communications.

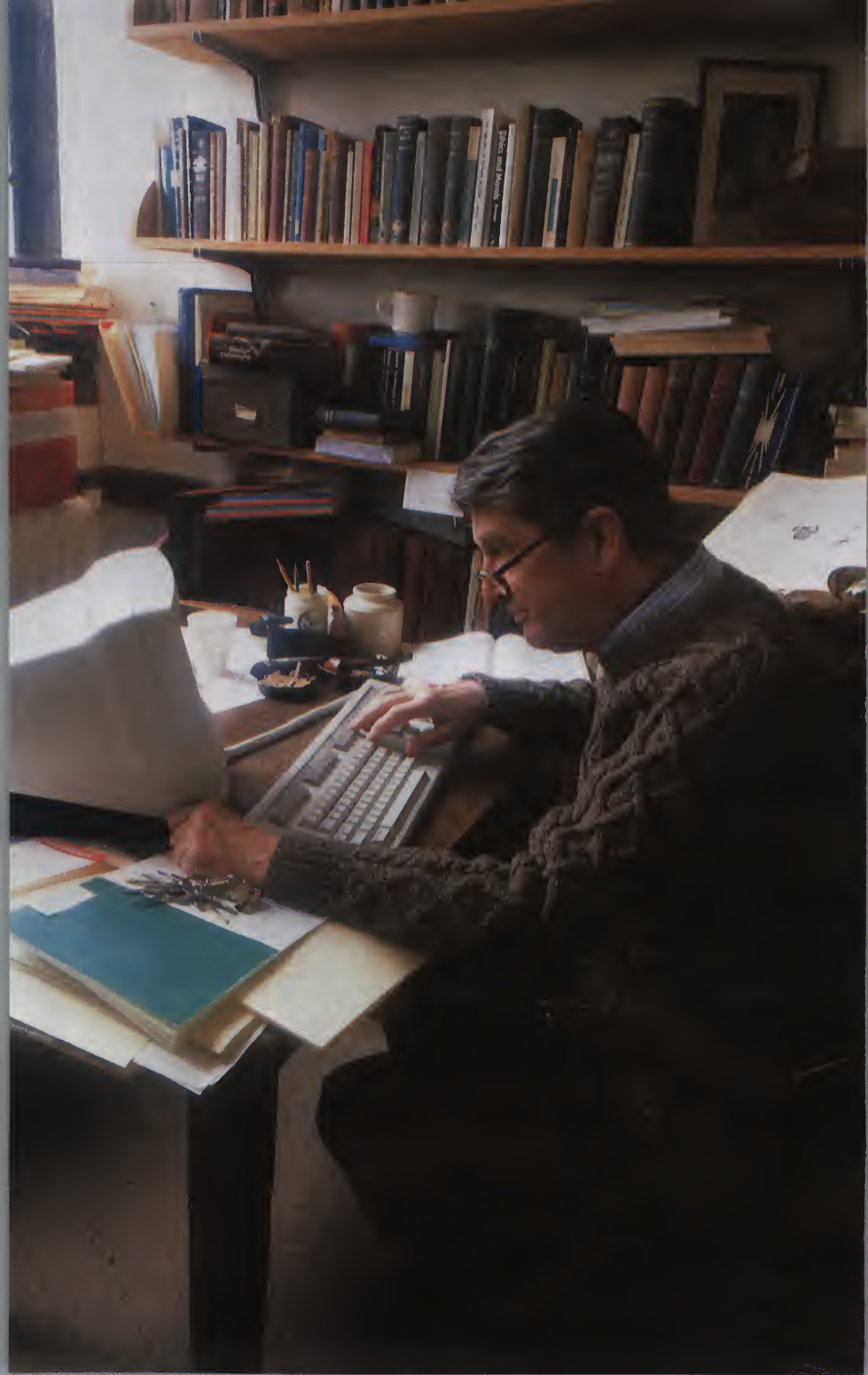
- **Comprehensive Accounting for a Small Business**

Barbara, the owner/manager of a small printing business, uses her personal computer for accounting, inventory, and payroll functions.

- **Information Management for an Entire Department**

Ellen, a marketing manager, is responsible for a promotional group that optimizes communications through an efficient network of personal and departmental computers.

These stories are not about actual businesses or people, but they accurately portray the capabilities of DIGITAL's personal computers.



Increased Productivity for Independent Professionals

An Accountant's Personal Computer

Roger is a chartered accountant who works independently out of his home. He uses his personal computer to prepare tax returns and as his major tool for analyzing investment and withholding strategies for his clients.

One of Roger's clients wants to realise some shares from his portfolio to provide the down payment on an investment property. The client needs to have Roger's advice on which shares he should sell. He also wants Roger to consider the long-term question of how the property taxes and the taxes on the rental income will affect his investment strategy.

Updating the Portfolio

Before Roger can provide this advice, he needs to check the recent activity of the shares in his client's portfolio. He enters yesterday's price and volume, the year's high and low, and other vital information on each share in his client's portfolio. This information is displayed on the screen of the personal computer and using the "Copy" feature of the computer, Roger prints a copy of the screen display.

Next Roger loads a program that will run an analysis on a share portfolio. This is one of several programs he has that were especially designed for accountants. He enters information regarding his client's shares, and the program does a complete analysis in a few seconds, displaying the results on the screen. The analysis shows which shares are doing well, which are lagging, and how they all compare to each other. Roger transfers this information to a diskette that contains his client's other financial records and has the analysis printed.

Considering All the Options

Now Roger wants to compare several different plans for selling some of his client's shares. He can do this comparison best with the spreadsheet program on the personal computer. This program uses information from another diskette that contains his client's previous tax forms. Roger set up the tax forms, which he maintains for all of his clients, using the spreadsheet program. The form already contains formulas that will calculate each line item on the return and all of the tax totals. All Roger has to do is change the input for any given tax item, and the spreadsheet program will create a new tax return.

To do the analysis his client wants, Roger enters the mortgage payments and the interest percentage. The program calculates the tax-deductible interest. Next he moves to the line of the return that records the capital gains. To see how each combination of shares sold will affect his client's final tax payment, he uses the split-screen capability of his personal computer to display both the capital gains portion of the form and the totals that appear at the end.

Roger now enters the figures for the sale of various amounts of his client's shares. The spreadsheet program will compute the net gain or loss and enter the amount under capital gains. The program then recomputes the entire tax return. In just a few minutes, Roger can do a complete analysis of how various share sales will affect his client's bottom line - the amount of his tax. He decides upon three or four combinations of shares to sell that give reasonable results and has the personal computer print the tax return that would be associated with each one.

For the next part of the analysis Roger copies his client's tax column several times and places them next to the current one on the spreadsheet. The computer program can make these copies without his having to retype all the labels and formulas. He will use these new columns in the spreadsheet to represent his client's returns for the next several years. Now Roger fills in these columns with figures for the rental income, mortgage interest deductions, rough estimates of deductible business expenses, and the rest of the information that will change with his client's purchase. The spreadsheet program can compute the new tax returns as fast as Roger can enter the changes. When he is done, he has a complete set of tax returns for the next several years. All are lined up side-by-side on the spreadsheet for easy

comparison. Roger prints these final spreadsheets and is ready to meet with his client.

The independent Professional

Roger uses a DIGITAL Rainbow 100 personal computer with DIGITAL's Letterprinter 100. This combination of equipment gives him a tremendous advantage in his business. The Rainbow 100 will run a wide selection of CP/M® software produced by many different firms (CP/M is the industry 8-bit operating system standard). This gives him access to many new programs being produced especially for his profession.

Roger also has a telephone modem and communications software that let his Rainbow 100 exchange information with other computers through phone lines, saving him time and money. He is able to handle more clients and reduce his costs. He is even able to create most of his business correspondence himself. He uses a simple word processing program to create and edit his letters and reports. The Letterprinter 100 can print letter-quality documents, as well as perform high-speed printing of tables and figures that Roger routinely uses. The versatility and professional quality of his DIGITAL personal computer and printer have put Roger ahead.



Improving Secretarial Efficiency

Professional Word Processing on a Personal Computer

Sheila is the secretary for a group of 8 people whose primary need is for professional-quality word processing. Her personal computer and its word processing software make every part of her correspondence work more efficient.

Right now, she needs to edit a long report. Her personal computer uses menus to list all of the things the computer can do. And there are indexes that list the names of all the documents Sheila has stored on the computer. Sheila could use the menus and the index feature to get to the report, but since she knows the document she wants, she just enters a brief version of the complete name and retrieves the report immediately.

The first problem with the report is that one of the subsidiary companies has changed its name. The old name appears many times in the 20-page report. To change it, Sheila selects the Global-Search-And-Replace feature and enters the old and new company names. The computer searches the entire document, finds each instance where the old name appears and replaces it with the new company name. The computer makes these changes to the entire report in seconds.

The first section that needs to be edited begins on page eight. Sheila's word processing software includes a Go-To-Page command that lets her bring this page onto the screen with a few keystrokes. It is easy to edit the document, using the labeled keys and the side keypad. Sheila selects a sentence that needs to be moved to the end of the paragraph. Then she presses a key labeled "Cut." The sentence disappears from the text. Using the directional keys, she moves the cursor to the new location and presses "Paste." The sentence has been moved, and the rest of the text has adjusted itself to the new position.

There is a paragraph on page 15 that needs to be moved to the end of the document to become the summary. Sheila uses the Go-To-Page 15 commands, selects and "cuts" the paragraph from its current position. To get to the end of the document Sheila uses a key labeled "Bottom Document." The bottom of the document appears on the screen and

Sheila presses the "Paste" key to complete this edit. The summary paragraph is now in the correct location.

The other minor editing takes only a few minutes with the rapid movement between pages and the labeled function keys on the personal computer. Satisfied with the revised document, Sheila is ready to print the report. She could do this process by following the choices in a series of menus that give her complete control over the look of the finished document. However, Sheila has already stored her standard print format in a User-Defined Key on her personal computer. By using this key, the report is sent automatically to the printer in standard departmental format.

The letter-quality printer will take a few minutes to print the 20-page report. But Sheila doesn't have to wait to begin her next project. Her personal computer can control the printing at the same time that she works on her next job.

Now Sheila is ready to prepare the cover memo that will accompany the report. Her personal computer has a special Library section where Sheila has stored the memo letterhead for each of the eight people who work in her group. With a few keystrokes she prompts the computer to retrieve the right memo letterhead and display it on the screen. Sheila only has to type in the name of the person the report is for and the sentences that describe its contents, and this memo is ready to print. She uses the same User-Defined Key to send the memo to the printer. The computer will hold the memo in a "print queue" until the report is finished and then will begin printing the memo.

List Processing and Sorting Features that Save Money

Specialized mailings are an area where professional-quality word processing improves efficiency. Sheila's next task is to send out personalized invitations to a product demonstration. She needs to send one to every account that does over \$30,000 worth of business with her company. And she needs a separate list of all the accounts that do over \$75,000 worth of business a year so someone can follow up the invitation with a personal call. The demonstrations will be in three different locations on different dates and this information has to be in each invitation.

Altogether, she needs to send nearly one hundred different invitations. Done by hand, they wouldn't get in the mail in time. Even conventional

word processing would be tedious and cumbersome. But Sheila's personal computer has two features, List Processing and Sorting, that can take care of the whole job in less than an hour.

Sheila already has a list of all of their customers stored on a diskette. It contains the names and addresses of hundreds of customers, information about their credit ratings, the volume of business they represent, and other key information. By preparing a Selection Specification she can have the computer search the list and generate another list of customers representing over \$30,000 worth of business. Another Selection Specification can sort the customers into groups, by postal code, so that their invitation will be to a nearby demonstration. And the lists can be made so that customers are in order, with the highest volume of business at the top. In a few minutes, Sheila prepares four customer lists, one for each of the demonstrations and one for the customers doing over \$75,000 worth of business a year.

While the lists are being printed, Sheila begins on the invitation. She types the invitation in a special way, using a short-code phrase for each part of the text that will change from one letter to the next. These code phrases match the labels in the customer lists. When she has finished this Form Document, she is ready to print the invitations.

She selects the List Processing option from the menu and follows the computer's messages to start printing personalized invitations for each company on the first list. Her letter-quality printer ensures that each invitation will be of the same high quality as an individually typed letter. When the invitations from the first list are finished, Sheila edits the invitation Form Document to replace the city location and date with the location and date for the next presentation. Then she starts printing the invitations from the second list. For the last set of invitations, she changes the location and date again and sends that list to the printer. That's all it takes for her to print nearly 100 personalized invitation letters.

Communication Between Personal Computers

Before she goes home that afternoon, Sheila puts a special diskette into the drive of her personal computer. This diskette is for sales and prospect information from the subsidiary companies in France and The Netherlands, both of whom are currently working Flexitime. It will be another three hours before their workday is over. At that time, a secretary will send the day's information to the home office over the telephone.

All Sheila has to do is leave her personal computer on and turn on the autoanswer modem that will receive calls and transfer the information to the computer. Sheila doesn't have to be in the office. Other personal computers, just like Sheila's, in France and the Netherlands can send the information directly to Sheila's computer and have it stored on the diskette in her computer. Tomorrow morning when Sheila arrives at work she can scan the information and transfer it to the collective sale-and-prospects files or print it for the group's information.

The Secretarial Workstation

Sheila works with DIGITAL's DECmate II personal computer. Its professional work processing features make all of her secretarial functions more efficient. The special Gold Key for selecting functions and the labeled keyboard make all her actions faster and easier. The 400 Kbytes of storage on each diskette let her keep all of the related information and correspondence on one disk where they are easy to find. The ability of her personal computer to do sorting and filing electronically means that she is able to find and maintain more information. Sheila uses DIGITAL's LQP02 Letter-Quality Printer to produce typewriter-quality printing of all the documents she creates.

The improved quality of secretarial support and information management that Sheila is able to provide has the additional benefit of increasing the productivity of every person in her department.

The LQP02 Letter-Quality Printer produces typewriter-quality documents.



$$21.48 \text{ Hz} \cdot 12.01 - 151.24 \text{ Hz} + 12.09$$

$$T_a = 208.24 \text{ Hz} \cdot 51.37^\circ$$



Improving Management Decisions and Efficiency

Planning with a Forecasting Program

Paul is a research manager for a large medical electronics manufacturer. He is responsible for his department's budget and uses his personal computer for planning and research. At this time he has twelve major projects that extend over several years and involve dozens of engineers and technicians.

The spreadsheet program and his personal computer are ideally suited to this sort of work. The program allows Paul to lay out a large sheet of columns and rows of figures to hold the values he needs for each product. He can define each number on the spreadsheet either independently or in terms of any other number on the page. Paul can use the program to calculate his department's budget based on the amount of time and engineering resources that will be devoted to each of the projects.

To arrive at a really accurate forecast, Paul needs to allocate his people and equipment for the next five years. The ideal spreadsheet for this forecast will use seven columns. Each column has to hold numbers in the hundreds of thousands of dollars. This isn't any problem for the spreadsheet program, but what will it look like on the screen?

In the middle of the fourth column Paul reaches the edge of the video screen. He could scroll over to the empty part of the page, but his personal computer gives him another choice. With a few keystrokes, Paul changes the set-up of his personal computer screen from 80 columns to 132-columns-wide. Now, all seven columns fit easily on the screen at the same time.

Paul enters the figures for all of the resources needed for each project. Below this he enters the amounts of engineering time and the number of support technicians that are required. All together, Paul has used 350 rows below each of his seven columns. He hasn't exceeded the memory of his personal computer and he's ready to begin developing his forecasts. In fact, Paul's personal computer has so large a main memory, he could have extended this same forecast over ten years without running out of memory.

	A	B	C	D	E	F
98						
99	TRANSFER COST		FY1983	FY1984	FY1985	FY19
100						
101	XP100-XX		162.90	171.48	180.50	190.
102						
103	-AA		214.92	276.00	253.92	233.
104						
105	-AB		81.45	85.74	90.25	95.
106						
107	-BA		150.56	134.72	121.12	110.
108						
109	-BB		249.87	348.56	298.78	324.
110						
110	-CA		335.67	387.46	397.66	431.
111						
112	-DA		787.43	814.90	820.45	830.
113						
114	-DB		645.32	645.98	623.12	783.
115						
116	-DC		233.12	267.39	289.45	298.
117						
118	-DD		578.34	623.33	612.96	645.
119						
120						
121						
122	COST DOLLARS					
123	(000'S)		FY1983	FY1984	FY1985	FY19
124						
125	XP100-XX		25780	58732	78333	834
126						
127	XP1XX-AA		23674	32457	31783	341
128						
129	-AB		450	1932	3110	27
130						
131	-AD		5677	5892	6235	67
132						
133	-BB		600	678	712	7
134						
135	-CA		1000	1232	1342	15
136						
137	-DD		320	345	378	3
138						
139	-EE		4438	4678	4889	49
140						
141	-FA		5783	459	5777	29
142						
143	-FG		7845	8923	9243	96
144						
145						

Saving Time

Paul's first "what if" prediction concerns the number of engineers allocated to each project. He enters new arrangements of his staff, and scrolls down to the total project costs.

To make it easier to see the results, he splits the screen horizontally into two different "windows." The top "window" contains his allocation of people and equipment and the bottom one contains the budget totals for each project. Now, every time he changes his resource allocation, the effect to his budget shows in the lower window almost immediately.

Paul tries dozens of different personnel and equipment arrangements in less than half an hour. Each time he sees the results for all five years of his projection quickly. And it is all displayed at the same time on the 132-column screen. Paul finishes several other forecasts having to do with inflation and operating expenses, the addition of some new equipment and the cancellation of some projects. He has only spent a couple of hours, yet he has confidence in his budget forecast. Before he had a personal computer, Paul did this forecasting much less effectively and less accurately and it took days to accomplish. Now he is ready to prepare his presentation.

A Graphic Presentation

Nothing makes a report more understandable than graphics. Paul's personal computer generates bit-mapped graphics that are accurate across a whole range of intermediate values and are very easy to read.

His business-graphics program can use the same data that the spreadsheet program has just generated. He can select the rows and columns of data that will be best represented graphically. The graphics program takes a row of data from the forecast sheet and builds a bar chart or a pie chart. It places the same labels and units from the spreadsheet onto the axes of the chart. Paul tries several different scales for project cost totals. Making the overall height of the bars larger clearly demonstrates the advantages of the budgeting solution he has selected. Next, he adds a title to the chart and inserts a summary paragraph below it.

Paul has a dot-matrix printer that accurately copies the same high-resolution bit-map graphics that are displayed on the video screen.

The printer will also print text within the graphics for labels and explanations. His printer can print 132-column-wide pages, so the spreadsheet appears exactly as it was designed, without the printout having to be cut and pasted.

The forecasts for resource allocation and budget fit very well onto a series of 15 graphs which Paul prints and gives to his secretary to copy onto overhead slides for the presentation.

Efficient Executive Text Editing

Paul uses an easy word processing program to create and edit his report. He has stored the heading and distribution list that he uses for his reports as a document so he can begin immediately on the text. The program makes it easy to correct typing errors and set up pages for conversion into overhead slides. Paul can make columns and tables and can print his headings in different sizes of type. The finished report takes very little time and it represents Paul's best thinking in a very persuasive form.

The diskettes on his personal computer have a very large storage capacity, so Paul's entire correspondence files for months fit on a single diskette. This is convenient because he can easily interrupt his report writing, "call up" other documents he has already created, and get specific figures. His word processing program lets him "cut" entire sections out of his older correspondence and "paste" them into new documents.

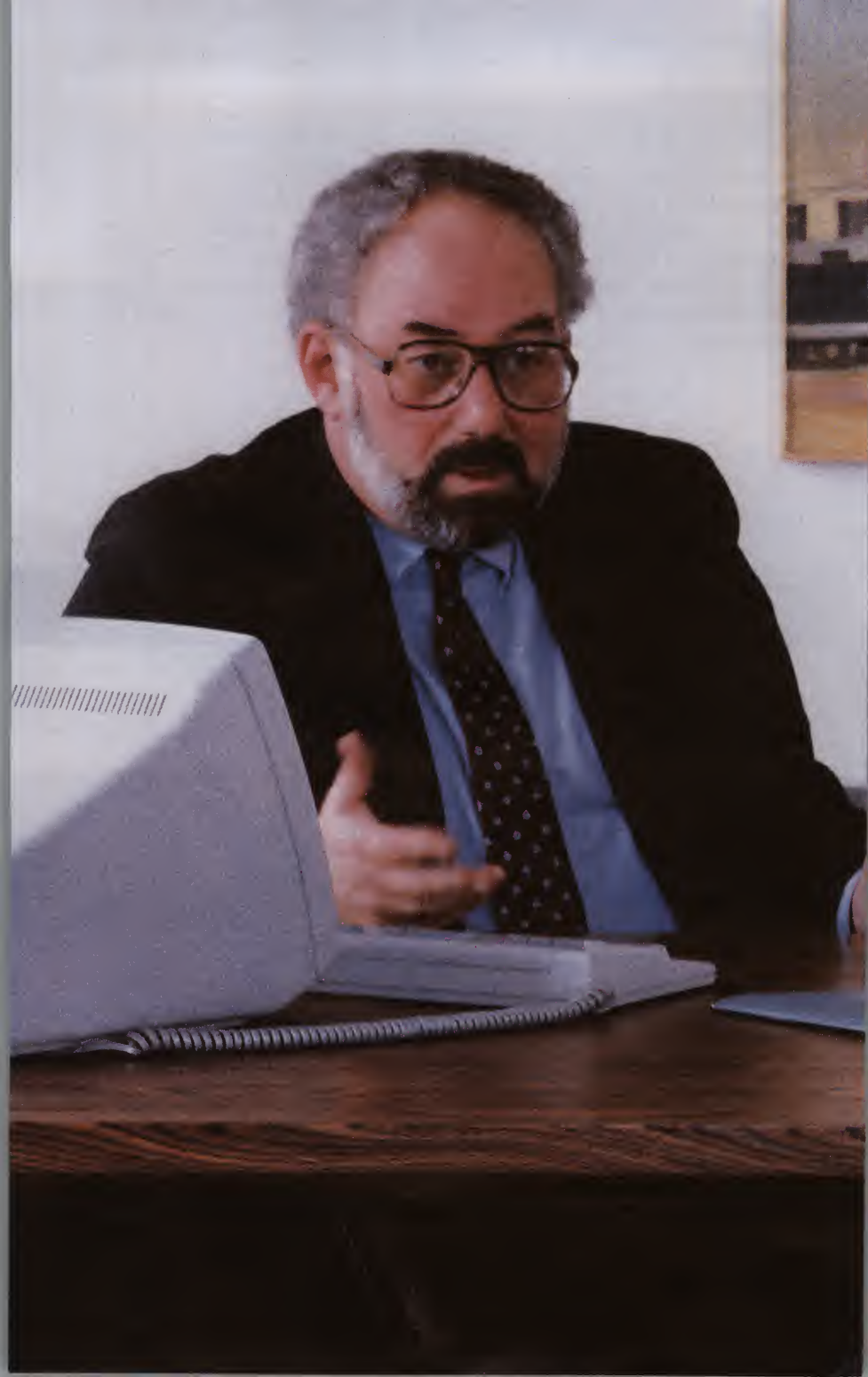
Enhancing Executive Productivity

Paul uses DIGITAL's Rainbow 100 personal computer with optional colour graphics. He has installed the full memory size of 256 Kbytes and has the standard dual-diskette drive with 800 Kbytes of on-line disk storage. Paul finds that using the computer is a much more accurate way for him to do the planning his job requires. With a DIGITAL Personal Computer he can run forecasting models that are as complex as the business situations he faces. He is able to react much more quickly to schedule changes and other variable conditions. His forecasts are accurate and he has the figures that support his predictions.

But the benefit Paul sees every day is the time he saves with his personal computer. The ease with which he can now do his reports, memos and presentations means that he can spend more of his working day planning and analyzing the best allocation of resources for his department. He uses DIGITAL's versatile Letterprinter 100 to print all of his graphics, memos, and even his letter-quality correspondence. With less mundane tasks, Paul can spend more time managing his department.

Letterprinter 100 control panel with control keys and status lights.





Managing the Information Flow

Saving Time and Money with Computer-to-Computer Communications

Len's company has decided to use the highest quality personal computers available, to increase their executives' effectiveness. Therefore they purchased personal computers with a hard-disk operating system that can do several complex tasks at the same time. These computers offered an optional telephone management system that further expanded their communications capabilities.

The data processing department in Len's company has created a series of programs that takes advantage of these advanced features. The programs don't require computer expertise to use. All the program choices appear on menus and if Len needs help with any portion of the program it is available at the touch of the Help key on the keyboard.

Today, Len is going to make a presentation to the top salespeople in Birmingham. And he is going to do it by computer from his office in London.

He prepared the report beforehand with the memo editor program on his personal computer and it needs to be transferred to Birmingham before the presentation begins. The Birmingham office hasn't opened yet, but Len can begin the transfer, because the personal computer in Birmingham has been left on and ready to receive the files over the telephone lines.

Communications between two computers always involves a number of very important set-up features. Both computers have to understand the type of signals and the speed of signals they will be sending and receiving. This information is technical and it differs among many of the company's computers. Len's personal computer stores all of the communications set-up information in a special phonebook file. To establish contact with the company's computer in the Midlands, all Len has to do is select Communications from the menu and enter the "name" of the other computer, "BM." His personal computer calls the phone number that the Birmingham computer is connected to, establishes contact, and sets the line characteristics.

Len is now "talking" directly to the computer in Birmingham over the phone lines. Before sending the presentation Len enters a password that prevents unauthorized access to that computer. Information

transfer over the phone lines takes between ten and forty seconds for a full typewritten page. it will take a while for the entire presentation to be transferred to the Midlands, but Len doesn't have to wait. His personal computer can continue with the job at the same time that Len is working on his next project.

Len needs to print several reports in his directory containing figures for the previous months' sales. He can use them for supplementary information during the presentation. He also needs copies of a memo for other departments. With a few selections from the menu, Len can send all of these documents to be printed one after another. His personal computer is now sending the presentation to the Midlands, printing the reports and the memo, and is still ready for more business!

Len wants to check the most recent orders to see if they support the points he is making in the presentation. He now uses the same Communications option to select a different computer to work with. This time he enters the "name" of the company's main computer located in the same building. His personal computer retrieves the communications set-up information from the phonebook file and connects to it. Len can now work with the company's main computer in the same way he would with any of its other terminals.

Len uses the company's main computer to examine the most recent orders from all sales regions. Then he feeds this information into a special program his company developed that generates a colour-coded graph of the sales data. The main computer transmits the colour graph to Len's personal computer. The high quality of the colour graphics his personal computer displays lets him see at once how each region is doing. After examining the graphs, and confirming his analysis, Len is ready for the presentation.

Long-Distance Information Exchange

Before starting, Len collects his reports from the printer and organizes them along with his other notes. Checking the Message Board on the personal computer to make sure that the entire presentation has reached the Midlands, he is ready to go.

Len's personal computer is still connected to the computer in Birmingham. Now he uses the telephone management system menu to open a second telephone line to Birmingham. He enters the "name" of the Birmingham office, and his personal computer automatically dials the Midlands and activates the speakerphone on his desk.

Len can now talk to the salespeople assembled in the Midlands over the speakerphone connected to their personal computer. They can talk back to Len and ask questions during his presentation. Not only can he tell them about the new sales strategy, but he can move the same presentation across the screen of their personal computer at the same time he is moving it on his own. And he can use the cursor on both screens to indicate the points he is making in the presentation. Since the whole presentation is also stored on the disk of the the Midlands computer, his colleagues will be able to make a printed copy of the entire presentation later on their own printer.

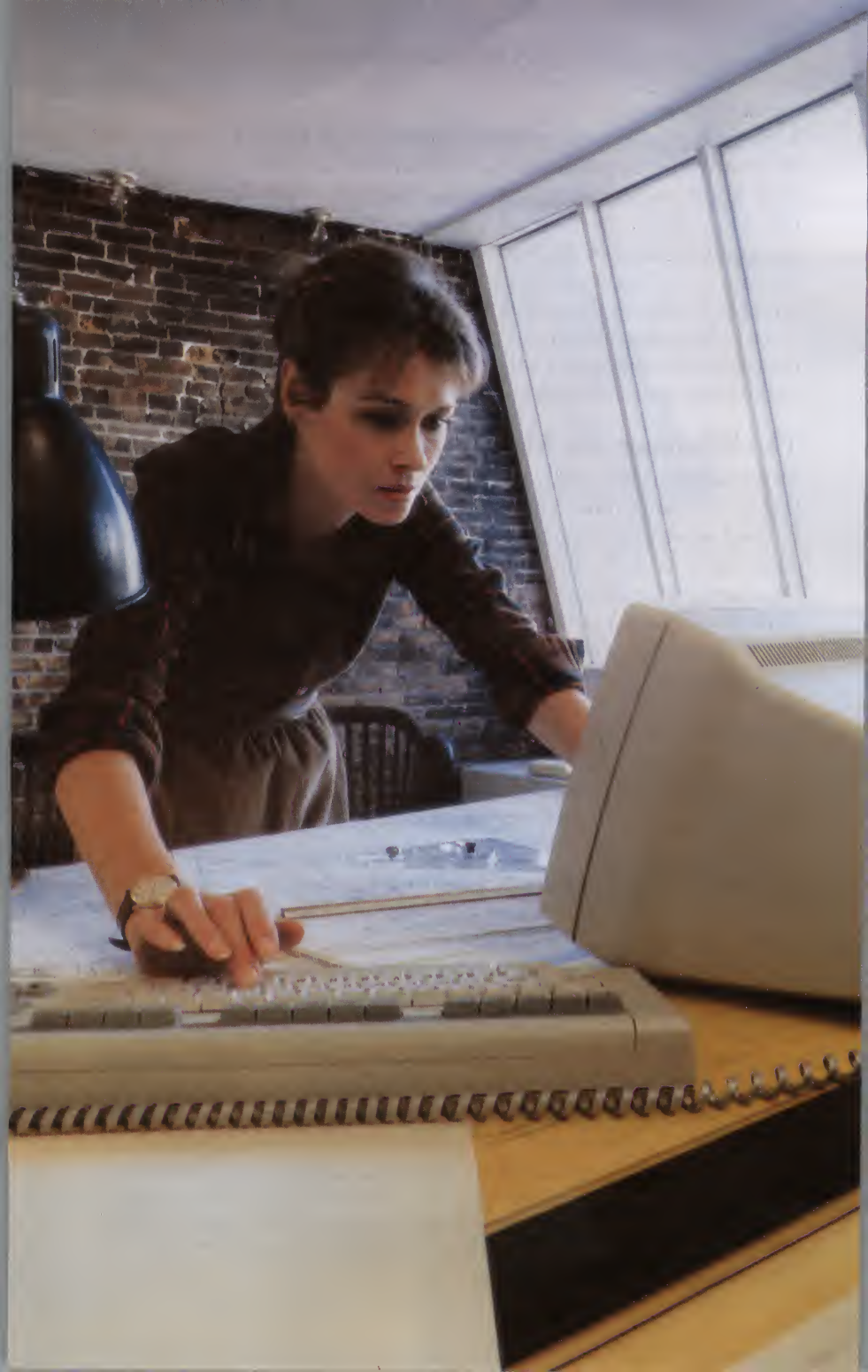
The Efficiency of a Multi-tasking Personal Computer

Multi-tasking is the ability of a computer to do two or more different jobs at the same time. This is just the capability that Len's company wanted when they purchased DIGITAL's professional 350 personal computers. Len's Professional and the one in the Midlands have the Winchester disk option. This disk, with five Mbytes of storage, can hold all of the company's special programs at the same time. The Professional has a true multi-tasking operating system that can use any of these programs and do many complicated jobs at the same time. This multi-tasking ability saves Len and the company time and money. Len's Professional and the one in Birmingham are equipped with the telephone-management system option that includes the modem for data transfer, a speakerphone for conference calls, and the auto dial capability for two phone lines.

Len's computer also has the extended bit-map option that gives it remarkable colour graphics capabilities. It can display eight colours at a time from a palette of 256, with high resolution. Complex information can be displayed graphically and still be differentiated accurately by colour. This lets Len and the other executives easily assimilate large quantities of data contained in the company's main computer.

DIGITAL's Professional 350 gives Len and others at his company the ability to communicate vital information quickly and inexpensively. The Professional can work with other computers in a way that gives computer-to-computer communication real power.

Note: Because the Profesional 325 and the Professional 350 bring new advanced hardware capabilities to personal computing, software for some of the functions mentioned in this story is not presently available. In addition, the TMS option is currently available only in some European countries. Negotiations are under way with other European PTT's.



Comprehensive Accounting for a Small Business

Barbara is the owner/manager of a small printing business which does phototypesetting, production of pamphlets and other small-scale bindery pieces, flyers, reports, and catalogues. Her staff uses a personal computer with comprehensive accounting system software to perform their receivables, payables, inventory, and payroll functions. This software's interactive information handling and detailed reporting are helping her operation be very profitable.

Making Intelligent Cashflow Decisions

Barbara is currently going over the latest Cash Requirements Report printed by the accounts payable program in the accounting software package. This report gives the total amount of money required to pay all the outstanding invoices in the date range that Barbara has specified—in this case the current month. Because the invoices are grouped by due date and also indicate the discount date, she can see the amount she would save by paying selected invoices now and taking the discounts. Weighing this information against the cashflow in the bank accounts that the business holds helps her come to an informed decision about when to pay whom.

Normally, it would take days for her bookkeeper to compile such a report manually. Barbara now does this sort of analysis as often as she wants and fine-tunes her cashflow with confidence.

Processing an Order

Meanwhile, Bob, a sales representative on her staff, is taking an order from a customer over the phone. While he's on the phone, he has typed the customer's number into the personal computer to request information from the customer file. When the information appears on the display screen, Bob sees that this customer has a large outstanding balance over 60 days old. Bob asks for a cheque to accompany the materials for the new order. All customers are screened this way whenever they place an order and this has made a healthy difference in managing the print shop's receivables.

This customer agrees to cover his debt and Bob resumes processing the order. He inputs all the order information—100 copies of a report the company recently printed for this customer and 100 coloured covers—to the Order & Inventory Management portion of the accounting software. Later, when Bob inquires into the product file, he sees that this recent order depletes the inventory of covers to the reorder point. After various orders have been placed during the day and have assembled for shipping, Bob prints out the invoices and updates the Accounts Receivable portion of the software.

Putting an Invoice on Hold

The purchaser calls to tell Barbara that there are defects in a recently received shipment of paper, and she wants to put a “hold” on the corresponding invoice until she can straighten the problem out. Barbara puts the Accounts Payable program in the computer and enters the vendor, invoice number and date. This retrieves the correct invoice record and she puts it on hold.

Tomorrow morning, when this program prints cheques, it will automatically hold this one. At the same time, the program issues cheques for the print shop’s fixed payments—rents, insurance, etc.—and automatically enters the amounts into the outstanding payables which eliminates the need for manual entry.

Efficient Bookkeeping

James, Barbara’s bookkeeping clerk, finds his work is much less tedious now that the books are on the computer. At the end of each day, he assembles the posting reports, which list all the transactions entered that day, and places them in their appropriate binders for auditing. He also duplicates his files on other disks in case the originals are accidentally damaged. In the morning, James has the computer print statements for all his customers. Each statement lists amounts payable and itemized charges as appropriate, and even has a promotional message across the bottom. The computer also has word processing software so that James can send out reminders.

A Complete Small Business Computer

Barbara's printing business uses a Rainbow 100 and a set of accounting packages from a reputable software house. This computer and the software packages make a perfect team to manage all of her business records. Even the payroll is automated. The payroll program automatically accounts for the different payscales used at the print shop—hourly rates and salaries—and computes everyone's deductions and taxes. In January, it generates complete gross and net salary breakdowns which aid in tax preparation.

The system is rounded out with a DIGITAL LQP02 Letter-Quality Printer and DIGITAL's word processing software. Altogether, the Rainbow 100 and the accounting packages have improved the efficiency of every aspect of Barbara's business. In addition, a complete on-site service and support contract from DIGITAL provides telephone support for Barbara's software questions and ensures that the system will be serviced quickly, at her business, should the need arise.



Information Management for an Entire Department

Ellen is a manager within a marketing group that is responsible for writing all of the company's promotional literature. The business also creates a large number of internal documents—memos, studies, competitor analyses, etc. In addition, there are the forms, budgets and schedules that are necessary for the smooth operation of the department. All of this text and the entire information flow for the department has been placed on computers, and personal computers are the first link in this communications network.

The writers, managers and secretaries each have a personal computer on their desk. Every personal computer is connected by a communication line to a larger departmental computer that handles the tasks common to everyone—including printing, connection to the company's electronic mail system, and running complex programs that everyone uses.

Moving Large Volumes of Text

The writers that work for Ellen find that personal computers add greatly to their productivity. They can compose copy at their own desks on the personal computer and store their work safely in diskettes. When a printed copy of the work is needed, they transfer a whole manuscript to the departmental computer. From there it is routed to a high-speed lineprinter that makes as many copies as the writer requires.

Getting printed material reviewed is just as fast. A writer sends a "copy" to the departmental computer indicating all of the people who should receive a review copy. The departmental computer forwards copies through the company's electronic mail system to each of the people named. The reviewers can edit the copy or insert comments at their own personal computer and they can print a copy if needed. When finished with the review, the same mail system returns their comments to the writer. The departmental computer can act as the electronic file cabinet for over a million pages of literature and records. Moving copy electronically has saved an enormous amount of productive time for Ellen's writers. The review process is systematic and the final copy much more accurate.

When the text is thoroughly reviewed and ready for production, the writers can do all the necessary paperwork in minutes on the personal computer. Each of the necessary forms is available in a special library on the department's computer. This rapid, efficient method of producing and tracking promotional literature has dramatically reduced the cost of the company's entire promotional effort.

Increasing Management Efficiency

Ellen and the other managers make extensive use of their personal computers. They can compose memos and send them anywhere in the company over the electronic mail system. This mail is delivered instantly. Going through an electronic mailbox is an easier way to deal with the pile of paper that typically greets managers and supervisors. Ellen has even instructed her secretary to search through her mail file and put the messages in order by priority. She can also display an index of the names of everyone who has sent her mail and immediately bring important correspondence onto the screen.

There are special programs contained on the managers' personal computers that do long-term and short-term schedule planning. There are programs for budgeting and graphics. The graphics programs can create bar charts, pie charts and other business graphics.

The budgeting and scheduling programs work like the popular spreadsheet programs for executive planning. When Ellen is creating the schedule for each person in her department, the program automatically takes the writing time and document type/length information and adds it to the department's totals. Ellen can compare these totals with the department's budget and schedule printing and writing to match the department's resources.

The graphics programs let Ellen and the other managers take any portion of the planning spreadsheets and create graphic representations of the information. Their personal computers have bit-mapped graphics that can display information very precisely. Complete reports, including the graphs, can be sent to the printer through the department's computer. The printer can print the text and the graphs in order, just as they will appear in the report. The final reports for the department are stored on the larger computer. These records are protected and can only be accessed by

supervisory personnel using a password. This procedure is easier than trying to store this dynamic data in special restricted file cabinets.

Improving Secretarial Support

The department's secretaries also share the computer network. Their personal computers have the complete word processing software that they need to do high-volume, fast turn-around correspondence. From their personal computers, they can send internal letters, memos and announcements over the company's electronic mail system.

The secretaries also have access to a special "calendar" program that lists the appointments and meetings for everyone in the group. They can check anyone's schedule in seconds and can tentatively "pencil in" appointments for people. When people return to their desk, their personal computer will automatically display a message on the computer's message board so that they can check these new appointments.

Personal computers have made taking phone messages faster and more efficient. The secretaries can type the message onto a prepared form. After the message is taken, the computer files it in the person's "message box" on their personal computer.

Since all of these scheduling and message-taking activities have been automated, the secretaries find they have more time for other productive work. Ellen has been able to let her secretary handle several important tracking projects—something that could never have been done before, given the constant stream of interruptions. With the electronic mail system, all of the writers and supervisors can handle more of their own internal correspondence and communications. This has released a tremendous amount of secretarial time.

Working Together

Computerizing communications in Ellen's department has meant more productivity from each member of her staff. The greatest side benefit has been the elimination of the "paper chase" and the "people chase" that used to be the only means of getting the job done.

Ellen and the other department managers use DIGITAL's Professional 350 personal computer with the 5 Mbyte Winchester disk option. This added memory capacity lets them manipulate large

quantities of records and use complex planning and graphics software.

The writers and marketing personnel in the department use DIGITAL's Professional 325 personal computers. The diskettes, used with the Professional 325, can store 400 Kbytes of memory each, to allow these workers to store large number of documents. And the Professional 325 has all of the communications capabilities required to keep its users in the department's communications network.

All the secretaries in the group have one of Digital's DECmate II personal computers. DECmate II provides the professional word processing performance and the communications capabilities needed to help them manage the movement of large amounts of information over the electronic mail system. For instance, whenever the company changes the format of the order form, the secretary can change the form once in the departmental computer's library, and the entire department will be immediately using the new format.

The Professional Developer's Toolkit lets the data processing department custom-design software that will perform the specific functions Ellen's department needs. It also lets them put menus and "interactive" help messages into the programs that make computer operation easy and foolproof. The data processing manager is satisfied with the system's performance because he has designed all the interfaces between the departmental system and the company's main computers. He has no fears that Ellen's department will tie up too much system time. Every day, the shared information, shared forms and records, and fast personal communications save Ellen's department and the company time and money.

Note: Because the Professional 325 and the Professional 350 bring new advanced hardware capabilities to personal computing, software for some of the functions mentioned in this story is not presently available.



Chapter 2

What Do I Need to Know about Personal Computers?

Personal computers are available in a broad range of prices and capabilities — from inexpensive home models right up to complete small business systems. This chapter explains how personal computers work and it focuses on the features that make personal computers useful in business. The value of a specific feature depends on what sort of work you want your computer to perform. This chapter will help you determine which attributes are necessary and which features will be beneficial for your own personal computer application.

How Does a Computer Work?

Computers contain a series of miniaturized electronic circuits that operate by storing and transmitting electrical signals. They are capable of taking information in, storing it, retrieving it and manipulating it. This ability of computers to manipulate information in many different ways and store and retrieve information quickly makes computers valuable. For example, a computer can search an inventory list of hundreds of thousands of garments and determine how many are red, size 10, and made of cotton.

Before the computer can do its job, it needs to be loaded with a program. Programs, also called software, are very detailed instructions that tell the computer what to do. The computer and the software together make one unit that is capable of doing a particular job. Some computers are dedicated to a single job. These dedicated computers, like the ones in aircraft autopilots, always use the same program. Other computers can be used for many different tasks. By simply changing the program, the computer is prepared to do a different job. Personal computers are a good example of these multiple-use computers.

What Are the Main Components of a Computer?

The computer is made of several major parts that work together to manipulate and move information. It has a keyboard—very similar to a typewriter's—that allows you to enter information. There is a video screen that can display letters and numbers in the form of a typed page or graphic images and pictures. The computer also includes disk drives—equipment to “play” magnetic disks that store information in a form the computer can find quickly. Some personal computers use cassette tapes as their storage medium. Tape storage is slow and cumbersome for daily work, but it may be acceptable in some situations.

The computer has a processor and its associated integrated circuitry to do the “computing.” Computing can be calculating a value, searching for information on a disk, or just moving information from the keyboard into main memory. The processor stores information electrically in circuits called main (or primary) memory. Main memory holds the program that tells the computer what to do and holds the data that the computer is using. The processor has fast access to the information in the main memory. Additional information is stored on the disks, which are sometimes called auxiliary memory. It takes the processor more time to get information from the disk than from the main memory. However, the disk's storage capacity exceeds that of main memory. On some personal computers the processor, main memory, and auxiliary memory are housed together in a separate system unit.

You usually complete your computer system with a printer. Printers are essential for making paper copies of the text and graphics that are stored on the computer.

How Do You Communicate with the Computer?

You communicate with your personal computer primarily through the keyboard. This makes the computer easy to use because the letters and words you need to send to the computer can be typed just as you would on a typewriter. Personal computers let you use easy-to-understand command languages or menus. All personal computer keyboards are not the same. Almost all of them look like electric typewriters, but some have the touch of a small portable and some respond like professional office equipment.

DIGITAL's personal computer. From top to bottom: video screen (monitor), keyboard, system unit (with diskette drive), and optional printer.



You can tell the computer what you want it to do by selecting from a menu—a list of choices displayed on the screen. For instance, the menu might give you these choices:

```
-- MAIN MENU --
```

```
5/12/82 Wed 10:01
```

```
C   =   Create a new letter or document
E   =   Edit an existing letter or document
P   =   Print a letter or document
I   =   Index of letters and documents on file
D   =   Delete a document
F   =   Finished using the system
M   =   More main menu selections ...
```

```
TYPE the letter and then press RETURN.
```

By selecting from the menu, you direct the computer's operation. Ideally, your personal computer will have many different menus that list all the possible commands you need. You should also be able to go from one menu to another easily. The real advantage of a menu-driven system is that you don't need to memorize any of the commands that run your personal computer.

When you are working with information the screen will display it in the form of a typed page (unless you're creating graphics). A visual indicator called a cursor will show you where on the screen the "work" is being done. It should be easy to move the cursor across the screen by using control keys with arrows that indicate the direction of movement.

You can also communicate with the computer by loading a program disk into the disk drive. A program disk contains thousands of instructions that tell the computer how to do the particular job. It also contains the instructions that will display the menus of choices that let you direct the program.

Your disks can also store information or data. Your correspondence might be on one disk, the information for your forecasting spreadsheets on another, and your inventory records on a third.

How Does the Computer Communicate with You?

The computer will communicate with you primarily through the video screen. This is where it prompts you for commands or displays menus which you use to control the program. In fact, the letters on the screen are a form of computer communication. Pushing the keys merely sends the code for the letter to the computer. The computer has to receive the code and "echo" it back to make that letter appear on the screen. So, when you press a "T" on the keyboard and a "T" appears on the screen the computer is telling you "I received your message and it was a 'T'."

The computer can take letters from the keyboard much faster than any person can type. It even has time to check the code for sending or receiving errors. The computer sends letters so fast that it could easily keep up with a typist who typed 120 characters a second!

Personal computers usually give you messages on the screen when the program doesn't understand what it is supposed to do. Sometimes you need to retype a command or check the disk drives to make sure that the correct disk is inside. The quality of these messages makes a big difference in how easy your personal computer is to use. Suppose you were starting a memo that you wanted to name "Tuesday memo." Here are two messages that might appear:

- Bad name
- Area 1 already has a document named Tuesday memo. Press return to try another name.

With the second message you know exactly what to do and you can continue working. On some personal computers you can even get help messages at the touch of a single key. When you press this key the computer will explain the choices you have at that point in the program.

Personal computers use other signals to tell you what is happening. Audio and tactile feedback, for example, increase your awareness of the computer's actions. Useful features include the "click" of the keys and "beeps" to tell you that the operation has begun. These features help you work more efficiently and give your personal computer a professional "feel."

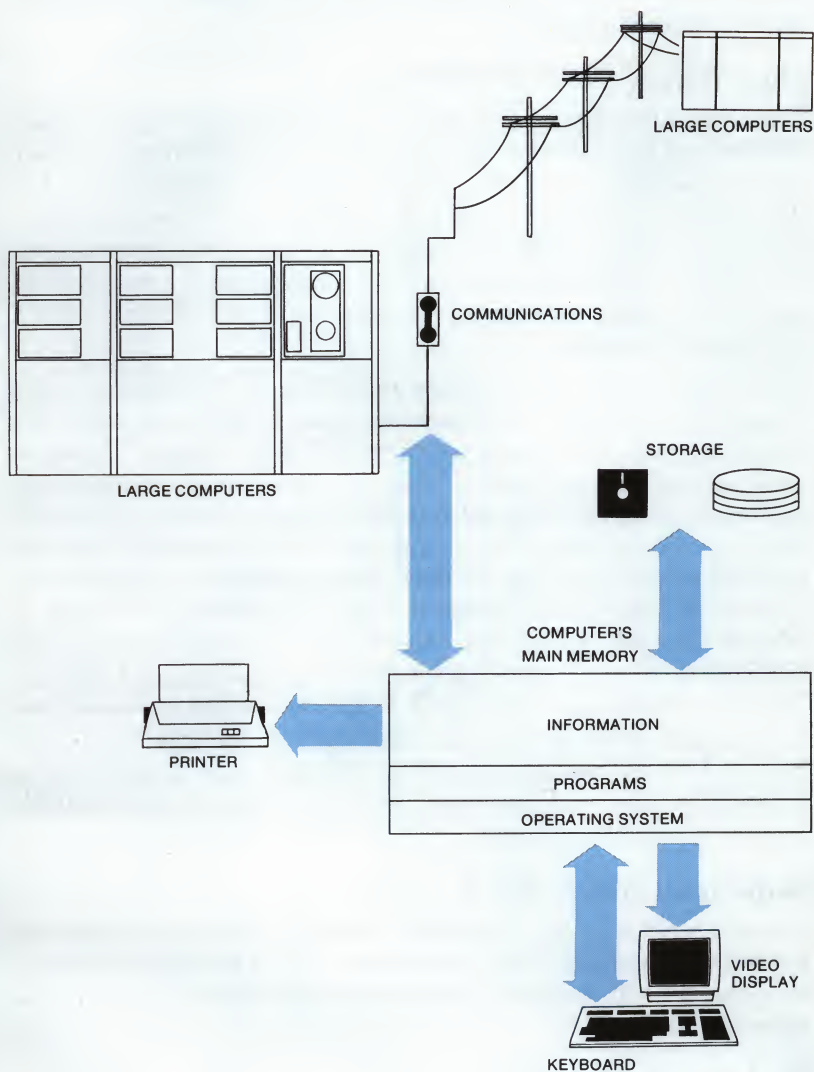
When something is going wrong, some personal computers are able to tell you. For instance, when you turn your personal computer on it might run a special diagnostic program to make sure that all the parts are functioning properly. Diagnostic programs return status information through a message on the screen or through the use of small lights called LEDs (light emitting diodes). This makes it easy to get the computer back in operation quickly, because the fault might be something as simple as no disk in the drive or a cable that has come loose. Being able to locate and fix minor problems yourself saves time and money by avoiding unnecessary service calls.

Where Does the Information Go?

Information moves very rapidly through your personal computer system. At the centre of this movement is the main memory of the computer which holds the program that is telling the computer what to do. The program pulls the information into the main memory before it manipulates it or sends it somewhere else.

When you are creating or editing a report, the editing program and the information you are typing are located in main memory. The computer sends the information from memory to the screen to be displayed. When you change a sentence, the program makes the change in main memory first, then sends the "new" information to the screen for you to see. When you want to store the report, the personal computer copies the information that is in main memory onto a disk. The report doesn't have to stay in disk storage. You might want to print a copy. In this case, the program copies the report from the disk—a section at a time—into main memory and sends it from there to the printer.

It is also possible to send the information to another computer. If the computer is in the same building, the information can be sent directly over a communications line. But if the other computer isn't in the same building, you will usually be communicating through telephone lines using a modem (which stands for modulate/demodulate). The modem translates the signals from the computer into high-frequency communications signals. These high-frequency signals can then be sent over telephone lines to another modem at the receiving end that translates them back to computer signals. Some modems plug directly into the telephone line and others use an acoustic coupler—a piece of equipment that accepts a standard telephone receiver. This is a



Where Does The Information Go?

convenient and inexpensive way to connect your personal computer to larger computer systems.

Disk Storage

The information that your computer uses is stored on magnetic disks. Disk storage is much more permanent than the information in main memory because it doesn't require electrical current to maintain it. The disks act like a combination of a record album and a recording tape. Like a record album, they spin around in the disk drive; information is recorded in "tracks" that are analogous to the grooves in a record. Disks are like recording tape because you can "record over" the information that is already on them.

Disks for computers come in three general types: diskettes (also called "floppies"), hard disks, and Winchester disks. Diskettes are made of a bendable plastic that has earned them the name "floppies." Diskettes work very well with personal computers because they are inexpensive and small enough to be stored and transported easily. Hard disks hold more information than diskettes and they are also removable. But most hard disks or disk packs are too large and expensive for use on personal computers. The most advanced form of information storage is Winchester disk technology. Winchester disks are permanently installed, hold much more information than diskettes, and they can access the information much faster. A Winchester disk is a sealed unit that contains both the magnetic disk surfaces and the "read/write heads." This technology allows disk units that store a great deal of information to be made very small. Winchester disks are now available on some personal computers.

Is the Information Safe?

Can you really trust your personal computer to store your important business information? The answer is yes. With a few precautions you shouldn't have any trouble keeping your vital business records on your personal computer.

Backing Up Disk Files

Although disks will faithfully store information for years, making a copy of important disks and storing them in a safe place is the easiest way to protect information. This is the way that important records are routinely duplicated. In the unlikely event that something happened to the original disk, the back up disk could be put on the computer, and business could continue.

For very critical information, you should make more duplicate copies of your files and store them in different locations. Printing of a copy of the information on paper also provides security. If something were to happen to the disk, the information could still be re-entered into the computer by hand. One accountant stores a printed copy of his client's records and a disk containing the information in a safe deposit box at the bank. A second printed copy and disk is in his office, and a third is left with the client. When he updates all of the records, he just replaces the old copies with the new set. The accountant and his customers are very satisfied that they will never lose valuable information.

Some personal computers will automatically prompt you to duplicate all your files. When you have finished using the system, the computer might display a menu like the following:

SIGN OFF

YOU HAVE NOT BACKED UP 8
FILES.

DO YOU WANT TO BACK UP NOW?

YES

NO

Internal Error Checking

The computer also spends a great deal of its time ensuring that it keeps the correct information. Whenever information is moved inside the computer, the computer copies it from one location to the other. When you are printing, for example, the information is copied from the disk into main memory, then again from main memory and sent to the

printer. This makes it easy for the computer to do internal error checking every time it moves information. It just compares the information in the new location with the original. If an error has been made, the computer will detect it and the information can be copied again.

How Does the Computer Work with the Information?

The computer sees information in a very different way than we do. Its circuits are designed to monitor electrical signals. Two states—electrical signals and no electrical signals—are the basis of what information looks like to a computer. At very high speed the computer can send or not send signals down a series of parallel lines. Current can be “read” at the receiving end and passed along or manipulated to cause other events to occur.

Bits and Bytes

Each line can be either on or off—signals or no signals. The two states are usually represented with 1 and 0. This method of passing information is called a binary (two-state) system. Codes using 1s and 0s have been developed to represent all of the information that the computer is working with. Each 1 or 0 in the code is known as a bit, which stands for binary digit.

bit	1 or 0
byte	8 bits
Kbyte	1,024 bytes (8,192 bits)
Mbyte	1,048,576 bytes (8,388,608 bits)

Storage

It takes 1 byte (8 bits) of disk space or main memory to store one letter or symbol.

A typewritten page holds 250 words (1,500 characters and spaces).

It would take 1,500 bytes (12,000 bits) of computer space to store a page as ASCII code. Therefore, it takes:

- 1.5 Kbytes of computer space to hold one typewritten page (in main memory or on a disk).
- 30 Kbytes of computer space to hold 20 typewritten pages.
- 150 Kbytes of computer space to hold 100 typewritten pages.

ASCII Code

The most popular code used for alphabetical and numerical information is the 7-bit ASCII code. ASCII stands for American Standard Code for Information Interchange. Almost all keyboards send the 7-bit ASCII code for the letters you type to the computer and the computer stores the 1s and 0s of the code in its memory or on a disk. Recently, an 8-bit code has been developed. The 8-bit code is used to represent a wide variety of international characters and symbols.

Character	8-Bit Code	Character	8-Bit Code
ä	11100100	£	10100011
Å	11000101	R	01010010
0	11011000	\$	00100100
é	11101001	k	01101011
ñ	11110001	7	00110111

Many of the records and documents that you work with will be stored in your computer as ASCII files. In those files every letter, number, and space takes eight bits of space. In most computers eight bits are equal to one byte. The size of main memory and the amount of magnetic storage on a disk are usually measured in bytes—the number of characters that can be stored there.

8-Bit, 12-Bit, and 16-Bit Computers

Personal computers are often categorized by the length of their instructions. These are typically either eight bits, twelve bits, or sixteen bits long. The individual instructions in a 12-bit or 16-bit computer can do a lot more work than the instructions in an 8-bit computer. Each instruction and data word contains more information and programs require fewer steps. This speeds program execution and data transfer. You notice the difference when the computer is doing a complicated spreadsheet program or professional word processing. Some personal computers can even do “parallel processing.” In this sort of computing two processors work on different parts of the same job together. The result is a faster rate of computing along with other features that make the computer easier to use.

How Much Information Can You Work With?

All of the information the computer handles has to go through the main memory. A small main memory can present severe limitations to the usefulness of your personal computer.

The memory has to hold three things at once—some essential operating system instructions, a program, and the information the program is using. System designers and programmers have to work out how much of the available main memory to allocate to each of these necessary elements. If the main memory is small, they will be forced to compromise on the space that each one needs.

A well-designed personal computer will have an optimum balance between memory and software. If the memory is inadequate, then the program must be limited, so that the computer will be easy to use. Operating systems and software that utilize this memory must be efficiently designed to match the functions they provide, so enough memory space will remain for the user's information.

All of these elements—the operating system, program, and information—have to work together within the memory. If the entire program can't fit in memory along with the information, the computer has to keep going to the disk to "read" the next part of the program. This not only makes the computer slow, it severely limits the way the parts of the program can interact with each other. The result is very rudimentary programs, and a computer system that is inefficient.

Memory size is usually measured in Kbytes. The main memory on personal computers typically runs between 8 Kbytes and 256 Kbytes. When you consider that one typewritten page requires 1.5 Kbytes of memory space—represented as ASCII code—it becomes obvious that 8 Kbytes or 16 Kbytes of memory simply are not adequate to deal with the amounts of information a business requires.

These "memory-limited" personal computers cannot compare with those that accommodate larger main memories. For example, a 256 Kbyte memory can store 170 pages of operating system instructions, program instructions, and user information at the same time. These larger main memories give adequate tools to everyone—the system designer, the programmer, and you, the user. There is room to provide a really powerful operating system. And there is room to accommodate more sophisticated programs that can do more work with the information. The computer will be easier to use because the program can include extensive menu selections and complete messages that

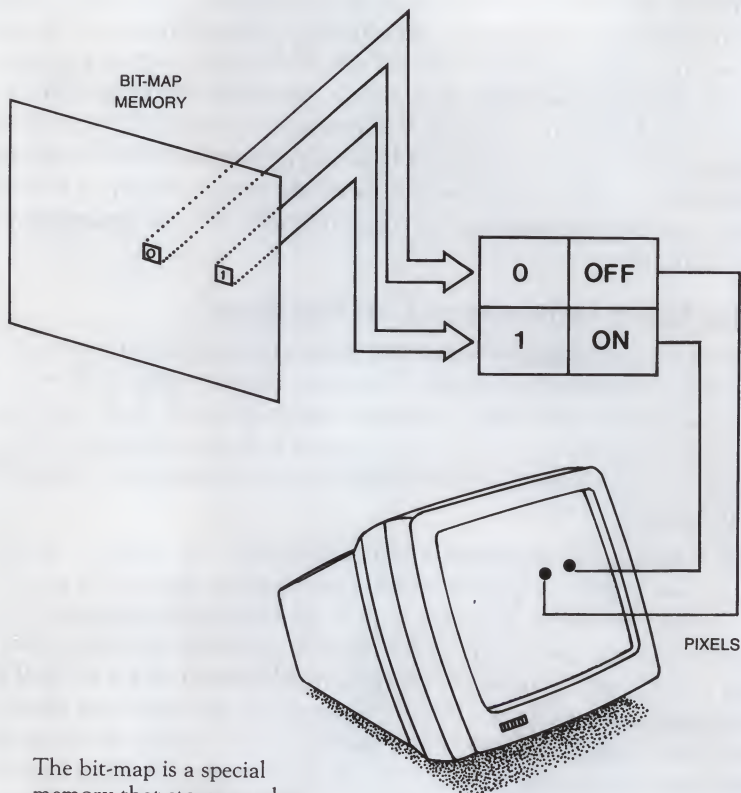
eliminate the need to use reference manuals as you work. And there is room to store and manipulate information — the real reason for using a personal computer. This is why the size of the main memory is such a critical factor in selecting not just a personal computer, but any computer. Additional memory will naturally increase the price of the computer. Personal computers whose memory exceeds 60 Kbytes can certainly do useful work. Beyond this level, it is necessary to find the most cost/effective amount of main memory for the programs you expect to run.

How Much Information Can You Store?

One of the potential problems with using a personal computer to keep business records is that many computers simply don't store enough information in one place. Magnetic disks don't all hold the same amount of information. A typical personal computer disk, for instance, will store only between 150 and 160 Kbytes of information — about 100 to 105 pages.

The records and documents that businesses use tend to become extensive quickly — especially when the computer does such a good job of sorting and filing. It is very easy to go beyond the capacity of the smaller storage media. And although you can keep changing disks to add new information, most programs need to have access to all of the information at once to be efficient. You can also add more disk drives so that the computer can have more than one disk “on-line” at a time. But there are limits to the number of disk drives personal computers can take, and it isn't cost effective to keep adding more drives to a computer with limited functionality. At some point, what you need is a more powerful computer. Some personal computers offer more information storage on each disk. This not only helps keep larger records, it actually improves the performance of your programs.

The biggest breakthrough in information storage for personal computers came with the introduction of small Winchester disks. These disks contain much more storage space and they operate much faster than normal diskette drives. Typical storage on a Winchester disk is five Mbytes — over 3,400 pages of information. All of this information is “on-line,” and the personal computer can locate any page and load it into main memory in much less than a second. This kind of performance is ideal for businesses that require large numbers of readily available records.



The bit-map is a special memory that stores a value for each pixel — picture element — on the display. During operation, the image on the screen is being continuously redrawn. The computer “reads” the bit-map as it is drawing the screen and determines individually which pixels should be on, and which off. Very accurate graphics and a large variety of print styles and sizes can be created on a bit-mapped display.

Bit-Mapped Display

You probably wouldn't want or need to use all of this space for information. The real advantage of combining main memory space and large, fast access storage capacities is that you can introduce sophisticated programs that do a great deal of the work for you. For instance, your information can be organized in a database format. This means that every record you store can be accessed through several different "keys." It is like having books listed separately under author, title, and subject at the library. The computer would be able to locate a specialized portion of the information using any combination of the keys. Such database structures are very important for inventory management, customer and client lists, and financial records.

How Does the Computer Present the Information?

Most of the information you work with will be displayed on the video screen. The clarity of the image and the amount of information that can be displayed depend on the "resolution" of the screen. The screen image itself is composed of tiny dots, or picture elements. The more dots the screen image is composed of, the more detailed the information that can be displayed. This becomes especially important when you are creating graphics or specialized text.

Some personal computers work with dots in predefined groups—character cell video. Each character cell can display one of a set of patterns which include all the letters, numbers, and other commonly used symbols. Character cell video is an ideal technology when your application deals solely with text.

A more sophisticated technology defines the screen in individual dot elements called pixels—picture elements. This is known as bit-mapped display. A bit-mapped display holds space in memory to control each pixel on the screen individually. Very accurate graphs, charts, and even pictures can be created on a bit-mapped screen. A bit-mapped display screen greatly enhances your personal computer's usefulness as a professional tool. Some personal computers even allow you to select colours for each pixel. This kind of screen is ideal for complex business graphics and colour pictures.

Some personal computers have other video screen attributes that are useful in business applications. Among these are the ability to extend the width of the screen to 132 columns, the ability to use italicized, bold, or oversized characters mixed-in with regular text, and split-screen capability.

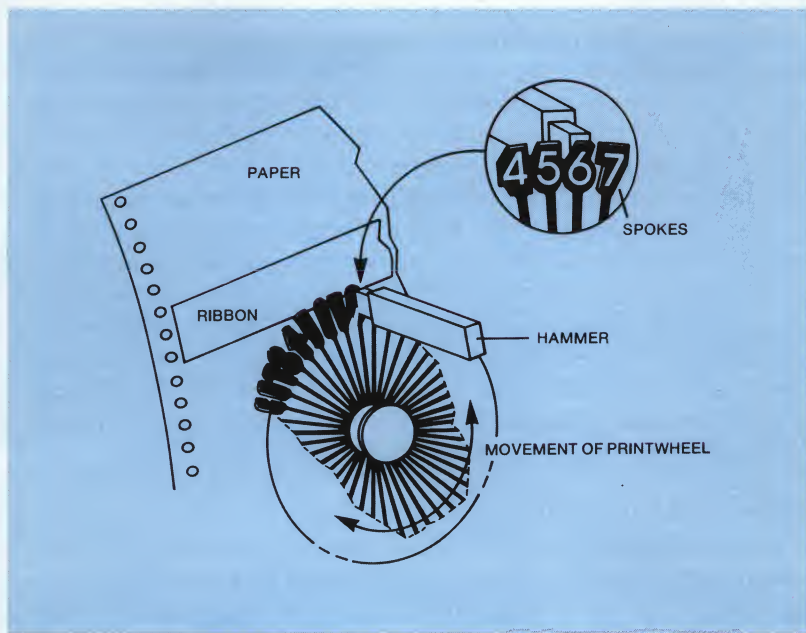
The other important way that you will get information from your personal computer is from a printer. Personal computers normally work with character printers, as opposed to lineprinters. Lineprinters are high-speed machines that print a whole line of information at one time. They are designed for applications requiring large quantities of output, such as computerized billing from credit cards.

Character printers come in two general types—formed character and dot-matrix. Most character printers use the same impact printing technique as a regular typewriter—an inked ribbon is pressed against a piece of paper to make a mark. Impact printers can produce crisp, clean copy and are capable of multi-copy printing.

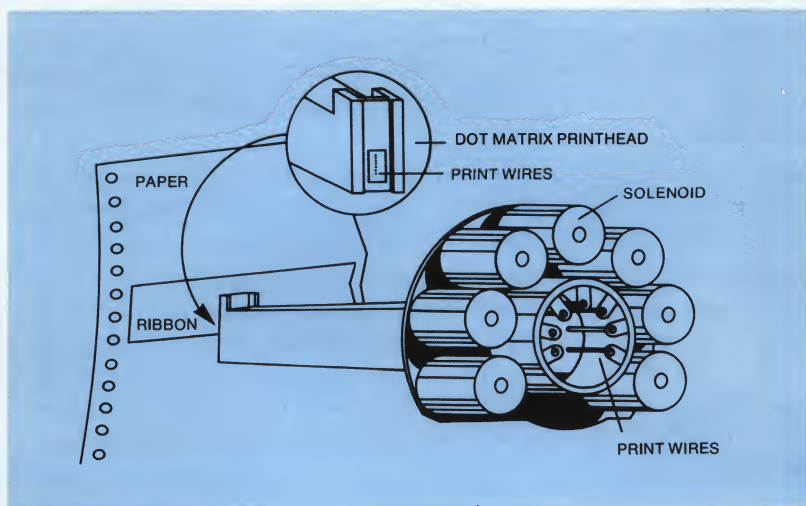
A formed character printer can give you a printed copy that looks just like a typewriter original. It uses a solid font for each character, much like a regular typewriter. One popular arrangement for the individual letters is on the spokes of a rotating disk. These daisywheel printers offer excellent print quality and moderately fast print speeds.

With a dot-matrix printer, a set of wires in the print head strikes the printer ribbon to form a character. Therefore, each character is composed of tiny dots. Dot-matrix printers will not produce copy that is as sharp as a formed character printer, but they have many other desirable characteristics. Some are very inexpensive, and some print very fast and offer a wide selection of print styles. Improved technology has allowed some dot-matrix printers to offer a print mode that gives letter-quality appearance. Premium dot-matrix printers will even print the same bit-mapped graphics that are displayed on the video screen.

Many times the printer is the weak link in a personal computer system. The amount of printing required for word processing or other business records demands a printer that is truly office quality. Equally important is the type of paper that your printer can use. A printer that can use regular office stationery, sheetfed paper, fanfold computer paper, roll paper, and can print on labels and multipart forms, is much more useful than a printer that cannot.



Daisywheel printhead. Each spoke has a raised character which hits the ribbon when the spoke is struck by a hammer.



Dot matrix printhead. The wire elements in the printhead strike the ribbon to form a character.

How Does the Computer Know What to Do?

A computer needs to be told how to respond to any given input. This is what a program does. The program is a series of instructions telling the computer what to do. The program describes when to take information in and what kind. It also tells the computer how to manipulate the information and when to store it, print it, or send it over communication lines. The computer goes through the instructions in the program one step at a time from the beginning of the program to the end. The reason that the computer appears to be so “intelligent” is that the program of instructions can contain branches or loops that define many alternatives for the computer to follow. And because the computer can process hundreds of thousands of instructions a second, it looks as though the computer “knows” exactly what to do. In fact, it may have tested thousands of alternative actions before finding the one that met all of the program’s criteria.

People and Programs

Programs are written by people. The quality of the programs you use depends entirely on the skill and imagination of the people who wrote them. Programs that are designed to help you be more productive will incorporate many features that make them easy to use. Menu-driven programs display your options and let you select what you want to do without having to remember commands. A complex program will require quite a few menus to adequately list all of your choices. Once you become familiar with the choices, going through the entire sequence of menus becomes tedious. Some programs will let you combine commands and effectively skip many of the intervening menus to get straight to work.

Some programs feature “context-sensitive” help messages. These messages correspond to where you are working in the program and give you only the choices that apply at that location.

The basic qualities of the computer and the imagination of the programmer go together. If the computer’s instructions, memory size, and storage space allow for it, a programmer can create software that will do a great deal of work and be very easy to use. By following the menu choices and the computer prompt messages you should be able to sit at the computer and almost immediately begin to do productive work.

How Can You Get the Computer to Do Useful Work?

The key to a personal computer's usefulness is the software—the programs—you have to run on the computer. Software manufacturers have provided programs for many different computer applications. The most popular of these are the spreadsheet calculator programs that can be used for everything from forecasting to accounting functions. Basic business-accounting packages are available that help control the buildup of paperwork in growing businesses and significantly reduce accounting costs. Beyond these are programs for business graphics, communications to information services, and specialized programs for various professions.

The Quality of Software

All programs are not of equal quality. The software developer tries to make the program available to the widest audience of that particular computer's users. What this has meant for personal computers is that the software tends to be written for lowest common denominator. For each model of personal computer, programs are written for the smallest system that will still do the job. Many of the most beneficial features of the software have to be left out because there isn't enough main memory or storage capacity to support them.

For this reason, it's important to choose a personal computer manufacturer whose computers come with a powerful processor, ample main memory, and large disk storage capacity as standard equipment. Programmers who write software for these personal computers are confident that every owner has the full use of the computer's capabilities. The programs reflect this knowledge in their extra capabilities, and they are much easier to use.

Another problem with software is the sheer number of programs available for each type of job. If you want to computerize the general ledger portion of your business, you will find literally hundreds of competing programs that all claim to perform this function very well. Some computer manufacturers have recognized this difficulty and they are evaluating and recommending different categories of software for their equipment.

Can You Design Your Own Software?

There are times when you might want to create a program to do some specialized work with your personal computer. You can certainly create your own software right on your personal computer.

You create a program by writing all of the instructions that will tell the computer what to do with each piece of information it will encounter while doing the job. These instructions are written in a programming language. The most popular programming language for personal computers is BASIC. BASIC uses simple English-like instructions that make it one of the easiest programming languages to learn.

What Runs the System?

Although the program tells the computer how to do a particular job, there are instructions that are more basic than the program itself. These instructions also reside in main memory and tell the computer how to do the steps that the program requires. There are instructions that tell the computer how to store information, print information, send information over communication lines, and perform many other common system functions. These instructions, known as the operating system, control the resources of the computer.

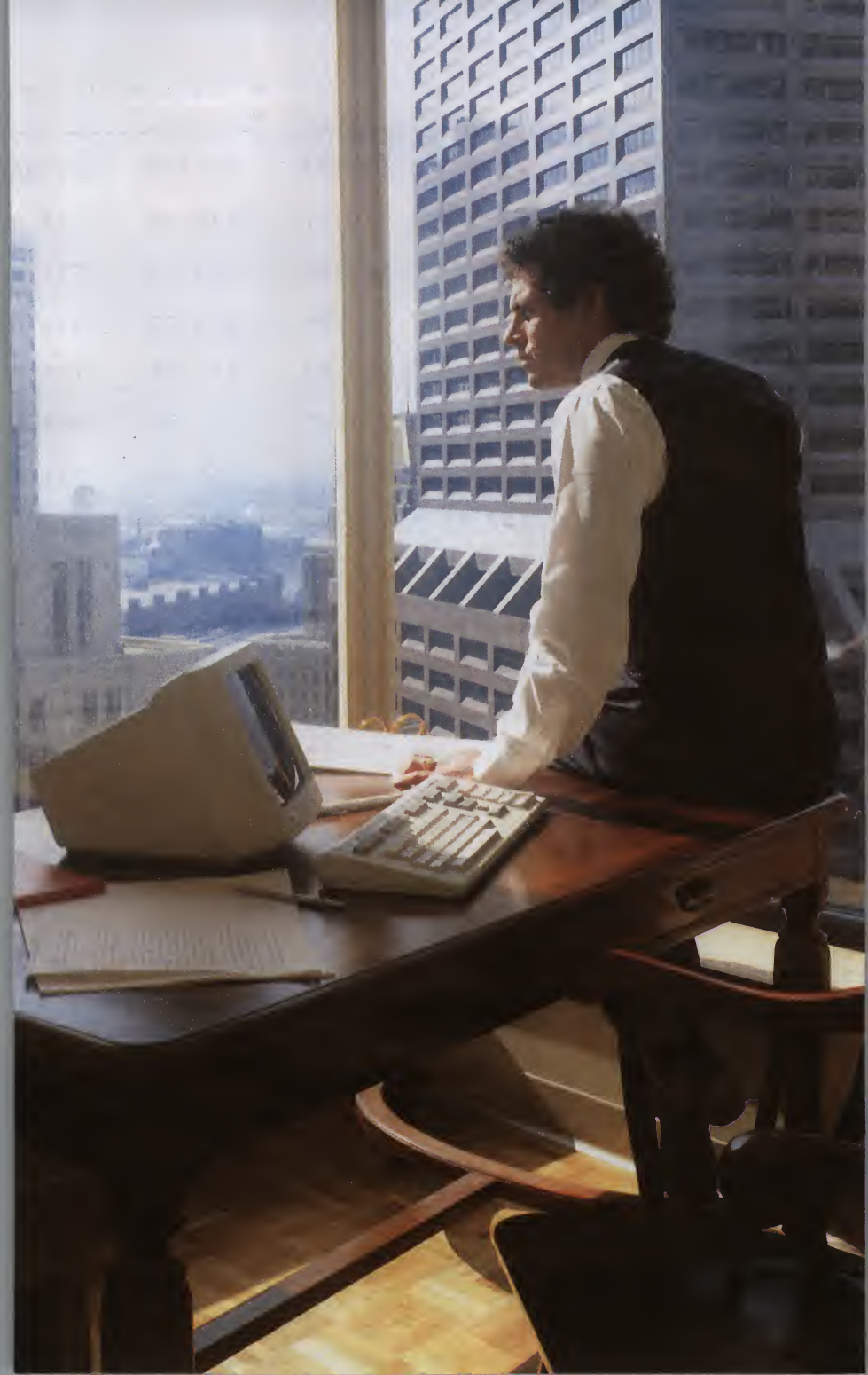
Most personal computers use operating systems that are single-thread operating systems. This means that they can do only one job at a time, and do that job from beginning to end without interruption. A single-thread operating system can be very efficient for specific productivity tools, such as spreadsheet programs. The operating system requires only a minimum amount of main memory, so the rest can be devoted to the program and the data. These focused applications can run efficiently on a less expensive system.

Computers That Can Do Two Things at Once

Almost all larger computers are able to do more than one thing at a time. How can a computer do two, or even three, things at the same time? The answer lies in the operating system. Most larger computers use an operating system that can handle several tasks simultaneously. These operating systems are more complex than single-thread operating systems and they necessarily take up more memory space. What the operating systems do is take advantage of the fact that the processor works much faster than any other part of the system. While the processor is waiting for some part of the system to finish a task, the

A single-thread operating system can be very efficient for specific productivity tools such as spreadsheet programs.

	A	B	C	D	E	F	G
53							
54	AVERAGE SELL PRICE						
55			FY1983	FY1984	FY1985		FY1986
56							
57	YP100-XX		110.00	110.00	110.00		110.00
58							
59	YP1XX-AA		472.82	607.20	558.62		513.9
60							
61	-AB		214.92	276.00	253.92		233.6
62							
63	-BB		107.46	138.00	126.96		116.8
64							
65	-CA		179.10	230.00	211.60		194.6
66							
67	-DA		286.56	368.00	338.56		311.4
68							
69	-DB		107.46	138.00	126.96		116.8
70							
71	-DC		89.55	115.00	105.80		97.3
72							
73	-DD		472.82	607.20	558.62		513.9
74							
75	VOLUME DOLLARS (000'S)						
76	(NOR)		FY1983	FY1984	FY1985	FY1986	FY1987
77							
78	YP100-XX		52750	42222	158250	126600	42200
79							
80	YP1XX-AA		5802	5244	8760	8877	2400
81							
82	-AB		10756	10929	19417	19401	3300
83							
84	-BA		900	1020	1710	1628	1550
85							
86	-BB		417	2878	3765	3878	4370
87							
88	-CA		2500	2780	3788	2998	3270
89							
90	-DA		7846	7943	8245	8562	8850
91							
92	-DD		567	623	648	678	750
93							
94	-EE		600	142	2030	1543	610
95							
96	-FF		4776	4882	4912	4978	5120
97							



operating system starts the processor on the next job. If the computer is printing, the processor just stores the information that will let it remember where it was in the printing process, then it goes on to the next task—like taking a letter form the keyboard and sending it to the screen. In this way, it is possible to interleave two, three, four, or even more jobs that all appear to be running at the same time.

These operating systems are known as multi-tasking operating systems. The availability of minicomputer processors, large main memory, and Winchester disk storage has made it possible to get a true multi-tasking operating system on some personal computers. Multi-tasking operating systems can be very efficient because they allow the computer to do a great deal of work simultaneously. This can be important in applications with a significant amount of printing, communication of files between computers, sorting, or calculating. With a multi-tasking operating system, the computer can perform non-interactive tasks and at the same time interact with someone.

How Can You Select Quality in a Personal Computer?

When you are looking for quality in a personal computer, there are several other things to consider beyond the features that are linked to the way your personal computer works.

More and more services are being established that provide computer-to-computer information through the phone lines. For you to be part of this information network, your personal computer has to be able to connect to these larger computers and act like a terminal on that computer. This process is known as terminal emulation. Through terminal emulation your personal computer can be used to access information on, and use the resources of, much larger computers. Terminal emulation capability can be an additional plus if your business already has larger computers. It is possible for your personal computer to be connected to the other company computers to take advantage of corporate computer services such as the electronic mail system and the use of information databases.

Your personal computer should have the same characteristics you look for in any piece of high-quality office equipment. It should be able to fit into your workspace and be built for continuous on-the-job use. Beyond that, you want a personal computer that is comfortable to use and logical in its operation.

There is a science of human engineering, known as ergonomics, that is concerned with designing equipment, operating techniques, and work environments that maximize human comfort and capabilities. It combines the study of human body mechanics and physical limitations with psychological study of people in different working environments. The result of good human engineering is equipment that is comfortable to use and that matches your mental and manual dexterity. You can do more work faster, with less fatigue and fewer errors.

For personal computers this means that video screens need to be carefully treated to reduce glare and should be adjustable to the ideal angle for any person using them. Low-profile keyboards that are lightweight and can be moved to a comfortable position are important. Special function keys should be located away from the typewriter key so that they are easy to find and unlikely to be pressed inadvertently.

Another good way to find quality in a personal computer is to look at the type of support the manufacturer is willing to give it. Personal computers that are just for home or hobby use may not need fast, professional support. But if you want to integrate a personal computer into your business, you need to be able to get a service contract that will assure you that the equipment is always working. Another important aspect of service is training. If the manufacturer provides useful training, you can reduce the inefficiency of having to show every new employee "by example" how to use the computer.

When you buy a computer for business you are just beginning a new way of dealing with information. Eventually you will need more computing power or even more computers. It is very important that the computer you select has features that allow you to communicate with other computers and let you easily upgrade your system. You should be able to add more storage capacity to your personal computer when you need it. This could be provided by another diskette drive or a Winchester hard disk.

The final selection feature you need to consider—and possibly the most important—is the software that will work on the computer. For a personal computer to be useful in business it needs to be able to run powerful programs that can work with the amount of information that a manager requires or that business records and correspondence require. It is also important to be able to choose software that the manufacturer will support and provide with a warranty that it will do the job it has been sold to do. Ideally, your personal computer should be able to run a wide range of software. Some personal computers are flexible enough to provide the services that often require a second or third computer. These services are usually a function of their being able to run sophisticated terminal emulation and communications software.



Chapter 3

DIGITAL's Personal Computers

DIGITAL's personal computers—the Rainbow 100, DECmate II, the Professional 325 and the Professional 350—are the beginning of a new generation of personal computing. They have been designed to cover the complete range of applications software, from industry-standard personal computer software up to the latest multi-tasking mini-computer software.

These personal computers set new standards for ease of use, the “human engineering” that has gone into their components, their advanced video display capabilities, and their large primary and auxiliary memories. In addition, they are supported by DIGITAL's worldwide service organization.

This chapter and the chapters on each of the three personal computers give a deeper level of technical detail than the first part of the book. Usually, these details appear in the form of Micro Specs, which are separated from the text, and contain technical information describing product and subsystem characteristics for comparison and evaluation. Because of the advanced nature of these personal computers, it has also been necessary to include some detailed information in the main body of the text to adequately describe the products. However, the personal computers themselves are easily installed and easily used without any knowledge of the technical details. Moreover, DIGITAL offers a full line of service and support products — detailed in chapter 6 — to insure your success.

DIGITAL's Personal Computers Share Many Common Features:

Ease of use— All of these computers feature software that makes learning and using the system easy and efficient. Some even have on-line help messages at the touch of a key.

Compact modular design— DIGITAL incorporated human engineering principles into the design of all the components—the keyboard, video display and system unit. The result is a computer that fits comfortably into your working environment and is easy to use.

The keyboard is low-profile, detachable, and lightweight. Its special function keys are separated into logical groupings. The video display is very small, yet it contains a full-sized, 12-inch diagonal screen. The screen angle can be adjusted for comfortable viewing. The system unit is designed to stand on end next to a standard-sized desk. The number of cords connecting the components has been kept to a minimum. One cord connects the keyboard to the monitor and a single cord goes from the monitor to the system unit.

Advanced video display— DIGITAL's personal computers support a full bit-mapped display as a standard feature on some models and as an option on others. The screen images of letters and numbers are exceptionally sharp and well defined. All of the personal computers support a 132-column-wide video display and most offer optional support for a colour display. Graphics generated on DIGITAL's bit-mapped display are very precise.

Terminal emulation— In terminal emulation mode your DIGITAL personal computer can function as a standard video terminal for larger computers. This flexibility gives you access to the information and services of the larger computers of your company or lets you connect to computer-to-computer information services. VT100 family terminal emulation software is available as an option with each of DIGITAL's personal computers.

Large primary and auxiliary memories— Both the primary and auxiliary memories are large. The removable diskettes, which are used by all of DIGITAL's personal computers, hold 400 Kbytes of information. Some systems can accommodate two disk drives, each containing two diskettes. Thus, with two drives storing 800 Kbytes each, total on-line auxiliary memory available is 1.6 Mbytes. A five Mbyte Winchester hard disk option that can expand auxiliary memory even further is available for all of the personal computers. On some models the Winchester disk is externally located, while on others it is integral to the system unit.

World-wide operation— DIGITAL's personal computers were designed with an emphasis on world-wide operation and compliance with international standards. Up to 15 different national language keyboards are available and the power supplies operate in most regions of the world.

Reliable and maintainable— As the world's largest minicomputer manufacturer, DIGITAL has 25 years of experience designing and

manufacturing computers. Our personal computers reflect this experience. We have implemented one of the most rigid quality control programs in the computer industry. All of our personal computers have extensive self-test diagnostics and a modular design for easy repair. Quick-release assembly allows the circuit boards, disk-drives and the power supply to be easily installed or removed by the user with nothing more complicated than a ballpoint pen.

Extensive service and support— DIGITAL offers extensive service and support for its personal computers. You have a choice of full on-site DIGITAL support, walk-in service, or mail-in programs. Comprehensive manuals and user documentation come with all the personal computers and computer-based instruction is standard on some models and optional on others. Consulting and educational support is also available directly from DIGITAL. Our commitment is to provide whatever it needs to help you use your DIGITAL personal computer as productively as possible.

DIGITAL's Three Personal Computers

DIGITAL's personal computers were designed to cover the broadest range of applications where personal computing would be useful. No single computer could adequately provide all the necessary performance and flexibility, so each of DIGITAL's personal computers has been optimized to be a leader in its area of software expertise.

There are currently thousands of programs that have been written for popular operating systems such as CP/M®-80 and CP/M™-86 — including some of the most popular spreadsheet calculator programs and accounting programs. All of this software has been designed for productive, low-cost personal computing. The Rainbow 100 was created to let you take advantage of this world of industry-standard software. It has been optimized for low-cost personal computing, while still retaining all of the features of a high-quality DIGITAL computer. The Rainbow 100 has two processors running in parallel to share system operations. Parallel processing gives Rainbow 100 a significant performance advantage. The two-processor design has allowed the creation of a hybrid CP/M operating system that combines both CP/M-80 and CP/M-86. Using this hybrid, the Rainbow 100 can run both 8-bit or 16-bit CP/M applications. The operating system automatically differentiates 8-bit and 16-bit instructions, invokes the appropriate subset of CP/M-80 or CP/M-86, and executes the software on the appropriate processor.

Small and large businesses need professional word processing capabilities. DIGITAL has brought this ability to personal computing in the DECmate II. DECmate II uses an enhanced version of our proven DECmate I word processing software. This production-oriented word processing system features a keyboard that is optimized for text editing and a Gold Key that turns many of the keys into special function keys. Easy to learn and very efficient to use, the DECmate II has all the features of the most advanced word processing systems. With DECmate II's list processing, sorting, and mathematics software, this personal computer can handle most of the complex filing and correspondence tasks that confront small and larger businesses. The DECmate II will also run DIGITAL's fully-supported business software with the installation of the CP/M option module. This software will manage all of the accounting records and reports for small or medium-sized businesses. DIGITAL's business software and professional word processing software together on the same computer make the DECmate II a complete small-business computer system.

The most advanced DIGITAL personal computers are the Professional series. The Professional 325 and the Professional 350 are both powered by a PDP-11 minicomputer and feature a standard 256 Kbytes of main memory. They have a true multi-tasking operating system based on DIGITAL's proven RSX operating system. At the same time they offer a menu structure and a help key that make them exceptionally easy to use. The Professionals are ideal for applications that require extensive communications or networking to other computers. They offer minicomputer performance with optional floating-point precision and the ability to develop sophisticated multi-tasking programs. Yet the Professional Operating System has been designed to allow the most complex programs to be used by anyone. All programs can contain consistent menus for commands and system operations and "context sensitive" help messages.

The Basic Components

Each DIGITAL personal computer system consists of a keyboard; a display screen (monitor), and a system unit containing the processor, memory, disk drives, power supply and options. You may also want to select a printer to complete your system.

The keyboard and display screen are identical for all the personal computers. There are, however, some differences in the functions assigned to certain keyboard keys. These differences are based on the applications software used by each computer.

With the exception of the Professional 350, DIGITAL's personal computers use the same system unit. The system unit has sufficient space to house the option modules that are available with each model, and some system units will accommodate two disk drives. The Professional 350 has a larger system unit and power supply. This gives it the ability to run a self-contained Winchester hard disk and other options. The Professional 350 comes with a standard diskette drive with the option to add the five Mbyte Winchester hard disk.

Most business applications will require a printer, and DIGITAL has three that are fully supported by all of DIGITAL's personal computers. For low-cost printing, the LA50 Personal Printer can run at two speeds and can print bit-mapped graphics. The Letterprinter 100, DIGITAL's most versatile printer, is a dot-matrix printer that will print at different speeds and will also produce very high-quality bit-mapped graphics. It produces very clear copy at 240 characters per second, and at 30 characters per second it will produce letter-quality copy. DIGITAL's LQP02 Letter-Quality Printer provides the highest quality copy of text. It features full font printing of each character and will print on regular computer paper, or multipart forms, or it will "sheet-feed" your own office stationery.

Selecting Your Personal Computer

Once you've determined that you need a personal computer, you then evaluate your personal computing requirements by the kinds of applications you want to run. Will your personal computer be mainly for personal use, or will it primarily be used for business or professional applications? Are you going to keep your business records or accounting information on the computer? Do you need professional word processing? Should you be able to exchange information easily with other computers? What are your printing requirements?

Answers to these questions can give you a good idea of the type of computing power you need. They can also tell you what general category of applications software you will be using.

Software Is the Key

Software falls into two general categories—operating system software and application programs.

Operating system software controls virtually all the system activity of your personal computer.

Application programs solve problems relating to your work—for example, spreadsheet calculator programs, accounting programs, and communications programs.

Your application programs are matched and added to the personal computer through the operating system software. Your personal computer's personality is largely determined by its operating system software and applications programs. Referring to a computer "personality" may seem odd. Some personal computers, however, are indeed more "friendly" than others, particularly from the novice's point-of-view. Friendly personal computers do more work with fewer instructions from you, and the instructions they do need are simple and clear in a friendly system.

DIGITAL's Sophisticated, User-Friendly Personal Computers

DIGITAL's personal computers have advanced hardware technology that makes them more friendly to use. Powerful minicomputer processors, larger memory and greater storage capacity make it possible for them to get more done with fewer instructions.

This advanced hardware can economically accommodate advanced operating system software and applications. No matter which of DIGITAL's personal computers match your needs, you'll get a generous series of easy-to-use commands or menus, help features and performance enhancements.

The following software is used on DIGITAL's personal computers:

- Rainbow 100 — 8-bit and 16-bit CP/M-86/80 diskette-based software, and others.
- DECmate II — 12-bit word processing/diskette-based software, optional Z80-based CP/M accounting software.
- Professional 325 — 16-bit multi-tasking diskette-based software.
- Professional 350 — 16-bit multi-tasking diskette or Winchester disk-based software.

DIGITAL's 5¼-inch dual diskette drive and low-profile keyboard.



System Overview for DIGITAL's Personal Computers

Keyboard:	Low Profile, Six-foot Cord, Detachable Audio and tactile feedback Function keys Numeric keypad National keyboards available
Monitor:	12-inch, High Resolution B & W Screen or High resolution colour screen 80/132 characters by 24 lines VT100 Family advanced-video features
System Unit:	2 Sizes
Microprocessors: Rainbow 100 DECmate II The Professionals	8/16-, 12-, and 16-Bit Z80™/8088 Dual Processor DEC 6120 (PDP-8), Optional Z80 Auxiliary Processor DEC F11 (PDP-11/23)
Diagnostics: Rainbow 100 DECmate II The Professionals	Built-in Power-up Tests Plain-text screen messages Plain-text screen messages Graphics display and codes
AC Power Requirements:	115 V or 230 V, User-selectable
AC Power Consumption:	Small Box — 218 Watts Large Box — 320 Watts
User Memory: Rainbow 100 DECmate II The Professionals	64K RAM Chips 64 Kbytes; expandable to 256 Kbytes 64 Kwords (96 Kbytes) 256 Kbytes

Micro Spec

**Standard Video Output:**

Rainbow 100
 DECmate II
 The Professionals

RS170 Compatible, Monochrome

Character cell video
 Character cell video
 Bit-map graphics

Standard Communications Port:**RS232 Asynchronous/byte synchronous****Standard Printer Port:****Serial****Software:**

Rainbow 100
 DECmate II
 The Professionals

Diskette/Disk Resident Operating Systems

CP/M-86/80, others
 WPS-8, COS 310, 8-bit CP/M
 Professional Operating System (P/OS)

Removable Storage:

Rainbow 100
 DECmate II

**Dual Diskette Drive
 (2 x 400 Kbyte, 5¼-inch Diskettes)
 Formatted, Dual-density**

One standard internal drive
 Additional internal drive optional
 One standard internal drive
 Additional internal drive optional
 One standard internal drive
 One standard internal drive

The Professional 325
 The Professional 350

Fixed Storage:

Rainbow 100
 DECmate II
 The Professional 325
 The Professional 350

5 Mbyte, 5¼-inch Winchester Disk

Optional external drive for data
 Optional external drive for data
 N/A
 Optional internal drive

Selecting Your Software

DIGITAL produces some of the finest and most reliable computer software in the industry. Yet there is a large variety of other software designed by independent vendors to run specifically on DIGITAL's personal computers. Some of this software meets the same high standards of performance and reliability as our own, and we want to identify it to owners of our personal computers. To accomplish this we have set up a system of approval ratings to help you choose high-quality software for your DIGITAL personal computer. A rating will be clearly marked on all the software that has met our strict requirements, so you will have an exact idea of the level of reliability and performance you can expect. And software in our most extensively tested category, DIGITAL-Developed, gives you the added assurance of DIGITAL's Software Support.

There are three categories of software ratings:

- **DIGITAL-Tested**— The "DIGITAL-Tested" seal means that we have checked all details of the software package and found it will run as specified in the documentation. It has no known "bugs" or other failures and will meet DIGITAL's criteria for installation, ease of use and performance consistency.
- **DIGITAL-Serviced**— Software packages in this category have passed the requirements of the "DIGITAL-Tested" category and, in addition, have met serviceability criteria set by DIGITAL's Software Service organization. The Software Service organization will offer a service contract to users of software bearing this seal.
- **DIGITAL-Developed**— This software seal is reserved for our own software product offerings, which meet the quality standards expected of DIGITAL products and which offer the traditional high level of DIGITAL service and support.

Outside of this ratings program, DIGITAL also maintains a referral list of third-party software to help you get an idea of what else is on the market that might meet your needs.

DIGITAL's Human-Engineered Personal Computers

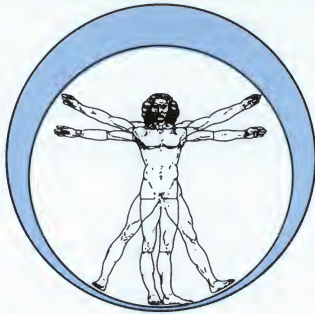
Human engineering is very important to DIGITAL. As the company that took the computer out of the computer room and brought it to where the work was being done, we have always been aware of the need for computer equipment to be comfortable to work with. We have used

the latest findings from the science of human engineering to design our personal computers.

Human engineering studies the effects of every part of the work environment. The equipment or machines in your working environment present you with a series of challenges. If equipment is not carefully designed, the cumulative effect of these challenges and the other things you are required to do could reduce your efficiency or contribute to fatigue.

The design of DIGITAL's family of personal computers represents perhaps the most intensive efforts in human engineering of any computer system manufactured to date. Such efforts have resulted in a personal computer that is friendly and easy to use.

DIGITAL's personal computers are comfortable to work with, in any type of environment you work. The keyboard is the optimum height for efficient typing. Its shape, feel, typing angle and layout are comfortable and logical. And the function keys have been separated into logical groups, so you can return quickly to what you were doing when you were interrupted. The screen can be adjusted and you can move the keyboard to the most comfortable position for the work you are doing. We have also designed-in audio and tactile feedback that increases your awareness of what the computer is doing without having to always look. Altogether, the pieces have been designed to help you do more work faster, with less fatigue and fewer errors.



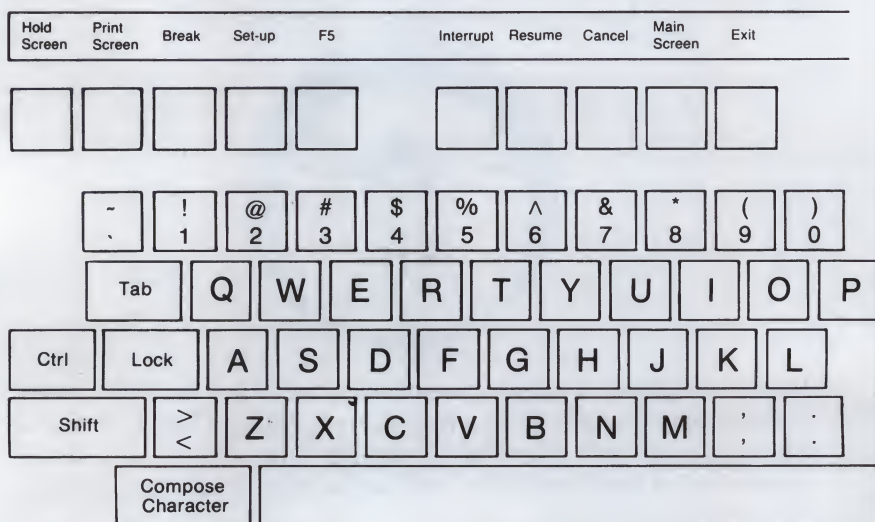
Human engineering applies to software, too. How well the system software has been written determines how easily you'll be able to give commands to your personal computer. The degree of software sophistication also determines how easy your personal computer is to use overall.

DIGITAL's DECmate II and Professional models feature sophisticated software that lets you select task and applications from a versatile menu structure. Although the Rainbow 100 personal computer uses a simple command language, most popular CP/M applications have menus of their own, complete with display instructions and prompts. Many of the CP/M command calls are written into the application by the programmer. You just run the application and follow its directions.

The Keyboard

The keyboard serves as the direct link to your personal computer. Because you use it to operate your personal computer, the keyboard's design and quality are very important. The difference between an adequate keyboard and a great one depends on how well it has been human-engineered and manufactured.

DIGITAL's low-profile keyboard is connected to the display screen by a six-foot (1.9 m) coiled cord that allows it to be moved to a comfortable position for working. It contains four groupings of keys, a small speaker, four light-emitting diodes (LEDs), and electronic circuitry. The keyboard is thin and lightweight and has an eight-degree slope.



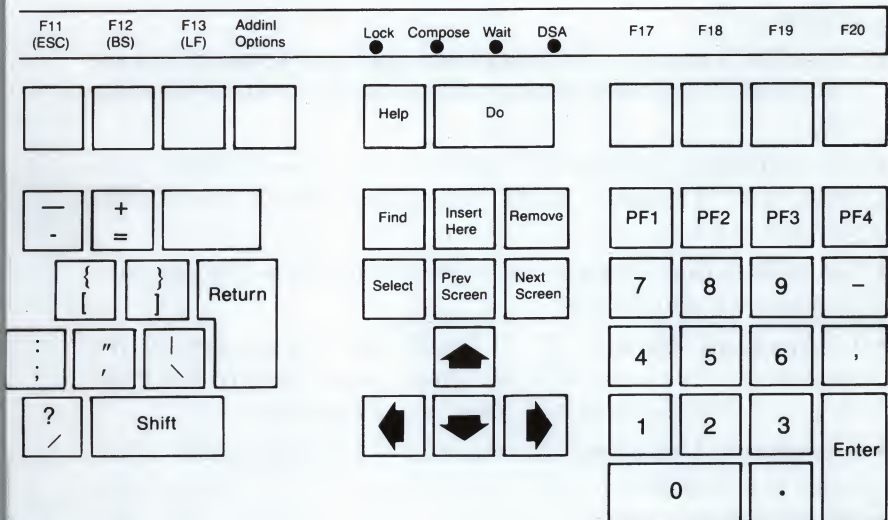
The keys are organized into logical categories for easy learning and remembering.

Because it is detachable, you can sit where you are most comfortable without feeling cramped or tied to the display screen. The keyboard can be placed in the ideal position, even if that's on your lap.

Proper arrangement of keys can help eliminate errors and increase your data entry speed. The 103-key keyboard for DIGITAL's personal computers has been carefully arranged so the typewriter keypad, editing keys, numeric keypad and special function keys are easy to find and use.

Keys feature matte-finish keycaps with dark-on-light legends and have been grouped by function. The large typewriter-like main keypad is used to enter alphanumeric information. The numeric keypad may be used like a calculator. The keys between these two keypads move the cursor and text on the display screen; they are used for editing functions. You also use them to move the cursor when selecting menu choices. The arrow keys, for example move the cursor left, right, up or down.

Various command and function keys such as "HELP" and "DO" appear across the top of the keyboard. These are special function keys which work in concert with your personal computer's applications and operating system software for ease of use and convenience.



Some keys are not dedicated to a particular function. Program developers, however, may define these keys to perform a specific operation, or even a set of operations, in their program. These programs will be easier to use because they can make use of the extra keys.

In addition to its overall arrangement of keys, the keyboard offers the following advanced features for faster typing and data entry:

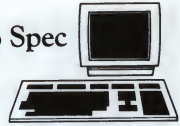
- **Sculptured Keyboard**— The low-profile, contoured keyboard is human-engineered to be comfortable and to offer the best height for home row keys.



- **N Key Rollover**— When two or more keys are pressed down, the keyboard transmits the last key you pressed even if other keys are not released.
- **Non-Slip Keycaps**— Provides contoured and textured keycaps with matte finish to reduce typing errors and glare from surrounding light.
- **Arrow Keys**— Inverted “T” format for up, down, left and right movement of display cursor puts cursor-control keys within convenient reach.
- **Set-up Function**— Lets you set keyboard and screen characteristics by displaying set-up menu.
- **International Keyboard**— “COMPOSE” function key on the Professional 325 and 350 lets you create Western European characters on all keyboards — regardless of language.
- **International Standards Conformity**— Meets European 30mm home row requirement and provides clearance for diskette drive media insertion, without having to move keyboard away from system unit.

Keyboard for DIGITAL's Personal Computers

Micro Spec



Electronics:	8-bit Microprocessor 4 Kbytes of ROM 256 bytes of RAM 4 LEDs Speaker
Cord:	6-foot (1.9 m), Coiled 4-pin telephone-type modular connectors Plugs into display monitor
Physical Description:	Low Profile, Detachable
Height:	2.0 in (5 cm) at highest point
Length:	21 in (53.3 cm)
Width:	6.75 in (17.1 cm)
Weight:	4.5 lb (2 Kg)
Keypad:	Sculptured Key Array
Home Row Key Height	30 mm Above Desktop
Keys:	103 Matte Textured-Finish Keys Concave surface
Size	0.50 in (1.27 cm) square
Spacing	0.75 in (1.9 cm) centre-to-centre (single-width keys)
Wobble	Less than .020 in (0.5 mm)
Numeric Keypad	18 Keys
Function Keys	36 Keys; Firmware- and Software-Driven 20 function keys horizontally positioned beneath label strip
Diagnostics	Powerup Self-test Generates identification code upon passing test

Display Screen Features

DIGITAL's VT100 family video terminals are regarded as an industry standard for video display performance.

The display screen for DIGITAL's personal computers has many of the advanced video features found on our highly successful VT100 family of terminals. In addition, this display screen has one of the smallest enclosures in the industry. It can fit conveniently on your desk or on a shelf. Combining advanced VT100 video terminal features — previously restricted to larger computer systems — and a compact package sets a new standard for display screen performance.

A black-and-white display is available with any of DIGITAL's personal computers. The black-and-white display screen measures 12 inches (30.5 cm) diagonally and is enclosed in a lightweight plastic case of contemporary design. With the addition of a colour/graphics option, you can provide colour output for a colour display.

The display screen can be adjusted vertically through a 30-degree range for comfortable viewing. A non-glare coating on the screen's surface reduces reflections, enhances character contrast and improves overall readability. Screen flicker is reduced by a 60-image-per-second refresh rate. Brightness of characters and background can be independently adjusted, as well as the screen contrast. A power switch and the controls for brightness and contrast are located on the side of the case for easy access.



DIGITAL's Rainbow 100 and DECmate II personal computers come with character cell video. The characters for both products are defined in the unit and support internationally native languages. The Rainbow 100 can optionally be converted to a bit-mapped display for either monochrome or colour output. The optional bit-map for the Rainbow 100 supports both a high resolution mode — 800 pixels by 240 pixels — and a low resolution mode — 320 pixels by 240 pixels.

DIGITAL's Professional 325 and Professional 350 personal computers come with monochrome bit-mapped video. Both Professionals can be optionally extended to support bit-mapped colour output. Standard bit-map resolution for the Professionals is 960 pixels by 240 pixels.

The following list summarizes the advanced features of the high-resolution display screen and the flexibility it gives you in displaying information.

- Standard or optional graphics hardware with bit-mapping gives you high-resolution graphics capability.
- Adjustable tilt screen accommodates a variety of viewing positions.
- Easy-to-read upper-case and lower-case characters show true descenders on all characters falling below the normal text line (y, g, j, q, p).
- Selectable 80- or 132-columns-wide screen lets you control how much information is displayed.
- Split-screen capability allows portions of the 24-line screen to be scrolled separately for menu selections, messages, or prompts.
- Full- and split-screen, horizontal and vertical scrolling for convenient, comfortable viewing of information.
- Reverse-video mode displays dark characters on a light background for your personal preference and/or lighting conditions.
- Double-height lines and double-width characters let you add emphasis to sections of text.
- Bold, blinking, reverse-video and underline features allow any character to be highlighted.

The 12-inch video display is compact and presents high resolution graphics.

Micro Spec



Display Screen for DIGITAL's Personal Computers

Characters:

Rainbow 100
and DECmate II

7 x 9 dot matrix
Includes 2-dot descenders

Professional 325 and 350

7 x 10 dot matrix
Includes 2-dot descenders

Format:

24 Lines x 80/132 Characters

Physical Description:

Height: 11.5 in (29.2 cm)
Width: 13.75 in (34.9 cm)
Depth: 12.25 in (31.1 cm)
Weight: 14 lb (6.4 kg)
Cord: 6-foot (1.9 m)

Adjustable Tilt:

+5 to -25 Degrees

Video Format:

Monochrome Composite

The System Unit

DIGITAL's personal computer system unit contains the system board, power supply, disk drives, and slots for adding optional devices. Attractively styled, the compact system unit can be positioned horizontally or vertically.



Placing the system unit vertically on the floor minimizes the amount of desk space required by the personal computer. A special vertical mounting stand, available from DIGITAL, must be used in this configuration to keep the system unit stationary and to ensure proper airflow for ventilation.

There are two different system units for DIGITAL's personal computers — a “small box” and a “large box”. The smaller system unit accommodates two diskette drives. The larger system unit can house a diskette drive *and* a Winchester hard disk within the same enclosure. The components and interior of the system units have been designed with snap-in, snap-out, and slide-out features for easy installation and maintenance.

The Rainbow 100, DECmate II, and Professional 325 all use the smaller system unit. The Professional 350 uses the larger unit. The major difference between the Professional 325 and Professional 350 is the ability to use a Winchester disk in the Professional 350's system unit. The Professional 350 also has more slots for options.

System Board

The system board is made up of electrical components and circuits. The major components of the system board are the microprocessor-control and logic circuits, memory chips, and communications hardware. The system board also has an area dedicated for mounting whatever option cards you might use to add more features to your personal computer.

The system board lies horizontally near the bottom of the system unit and slides out from the rear of the box.



Diskette Drive

DIGITAL's personal computers use a compact, reliable 5¼-inch (13.3 cm) diskette subsystem. It consists of a microprocessor-based diskette controller card and a dual-diskette drive accommodating two diskettes on a single spindle. The diskette drive is designed to run on all of DIGITAL's personal computers. Each diskette stores 400 Kbytes of information. With two disks per drive, this gives a total of 800 Kbytes of storage per drive — considerably more than most personal computers offer in with a single diskette drive.

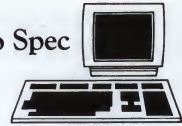
Applications and system software are stored, distributed and run on diskettes. In addition, the diskette gives your personal computer mass storage, data interchange and file duplication. If you have the Winchester hard disk option, you can also use it for auxiliary data storage and to duplicate the information on the hard disk.

The diskette drive holds two diskettes simultaneously. You use one diskette for system storage and the other for storing data. Contrast this to conventional diskette systems that allow you to use two diskettes only when you have two drives. The dual-diskette drives used with DIGITAL's personal computers give you the kind of performance and versatility that are usually found on larger computer systems — and at the lowest possible cost to you.

Installation of an optional second diskette drive is quite simple. You simply remove the cover from the personal computer system unit, slide the modular drive unit into place and insert the controller option card. A separate power cable with cannon plugs connects the drive unit to the personal computer's power supply.

The diskette subsystem contains diagnostics that test and verify that all system components are working during power-up. The diagnostics also provide continuous error checking during normal operation and maintain a "dialog" with your personal computer to report error status.

Micro Spec



Diskette Subsystem

Performance

Capacity/Drive:	819 Kbytes
Diskettes per drive	2
Number of recorded surfaces	2
Per track	5,120
Per sector	512 bytes
Sectors per track	10

Transfer Rate:	250 KB/s
Average Access Time:	290 msec

Functional Specifications

Rotational speed	300 r/min
Densities	96 tracks per inch

Physical Specifications

Height:	3.3 in (8.4 cm)
Width:	5.8 in (14.7 cm)
Depth:	8.5 in (21.6 cm)
Weight:	3.8 lb (1.7 kg)



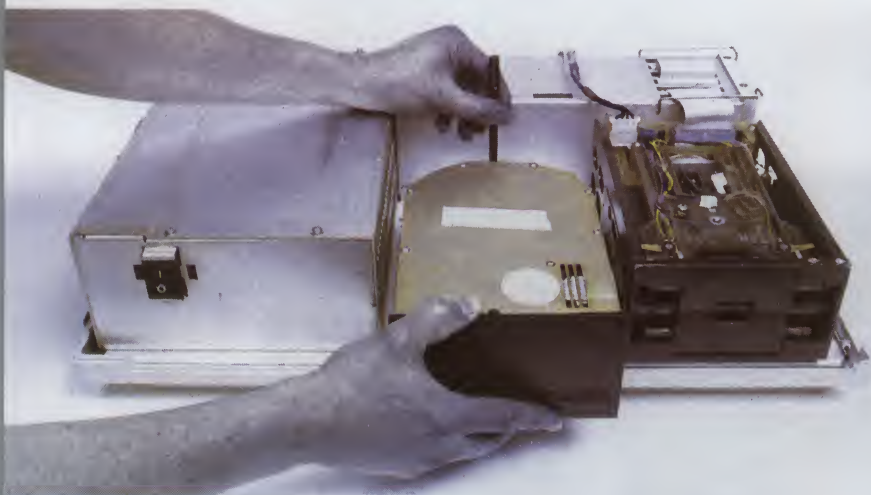
Winchester Disk

The low-cost Winchester disk consists of a controller card and a 5¼-inch (13.3 cm) Winchester hard disk drive. This system provides five Mbytes of formatted, fixed storage for DIGITAL's personal computers and gives six times the storage capacity offered by the diskette drive. In addition, the Winchester disk subsystem seeks out and transfers information noticeably faster than diskette drives.

The disk drive requires no preventative maintenance or adjustments. Winchester disks use a sealed head/disk assembly. A sealed assembly protects the fixed-disk media from dust and other contaminants. It also protects the media from wear that would occur from constant handling.

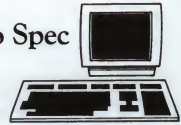
If you have a Professional 350, you place the Winchester disk subsystem inside the personal computer system unit. As with the diskette drives, you simply slide the disk drive into its designated bracket until it snaps into place. You then place the controller card in an option slot and connect a power cable from the power supply to the drive unit. No tools are needed.

The Winchester disk subsystem also has firmware diagnostics that test and verify that all components of the system are working during power-up. These diagnostics provide continuous error checking during normal operation and report the disk system status to your personal computer.



All components are easily installed or removed. You don't need fancy tools — a ballpoint pen will do.

Micro Spec



Winchester Disk Subsystem

Performance

Formatted Capacity:	
Per drive	5 Mbytes
Per surface	1.25 Mbytes
Per track	8,192 bytes
Per sector	512 bytes
Sectors per track	16
Transfer Rate:	5 M b/s
Average Access Time:	95 msec

Functional Specifications

Rotational speed	3600 r/min
Densities	254 tracks per inch

Physical Specifications

Height:	3.4 in (8.6 cm)
Width:	5.9 in (14.9 cm)
Depth:	8 in (20.3 cm)
Weight:	5 lb (2.3 kg)

Power Supply

The power supply converts alternating current (ac) into the direct current (dc) the system uses. It also transforms the dc power into lower voltages for the system board, keyboard, monitor and disk drives.

DIGITAL's personal computers plug into a standard wall socket. The personal computer's power supply can accommodate both 115 or 230 volts ac current. A slide switch in the back of the cabinet lets you quickly adjust the power supply to the appropriate voltage.

Like the system board and disk drives, the power supply is a modular unit that can be removed quickly from the personal computer system unit. This is done by removing the box cover, unplugging some power cables, and then pulling on two tabs to release the power supply from the bottom of the box. The power supply lifts straight up from the box for easy access and replacement.

Micro Spec



System Unit and Power Supplies for DIGITAL's Personal Computers

Small Unit Physical Description:

Height
Length
Width
Max. Weight

**Rainbow 100,
& Professional 325**
6.5 in (16.5 cm)
19 in (48.3 cm)
14.3 in (36.3 cm)
30 lb (13.6 kg)

Large Unit Physical Description:

Height
Length
Width
Max. Weight

Professional 350
6.5 in (16.5 cm)
22 in (55.8 cm)
14.3 in (10.9 cm)
35 lb (15.9 kg)

Power Supply Type:

**Transistor, Switch-Type AC to DC
Converter**

AC Input:

115V nominal

230V nominal

Switch-Selectable

Single-phase, 3-wire 90 – 128V rms
47 – 63-Hz Line Frequency
Single-phase, 3-wire 174 – 256V rms
47 – 63-Hz Line Frequency

Line Current:

Small System Unit

Large System Unit

3A @ 115Vac
1.5A @ 230 Vac
6A @ 115Vac
4A @ 230Vac

AC Power Consumption:

Small System Unit
Large System Unit

218 Watts
320 Watts

Regulated Voltages:

+5V, +12V, & -12V DC

Circuit Protection

**Circuit Breaker,
Externally Accessible**

Printers and Your Personal Computer

To complement this new generation of personal computers, DIGITAL is offering three printers: the LA50 Personal Printer, the Letterprinter 100, and the LQP02 Letter-Quality Printer. All will work with any member of the personal computer family.

At DIGITAL, we have been making printers for our larger computer systems for many years. In fact, these three printers are the same ones that are used on many of our larger systems. They have been designed and built for continuous, reliable service.

Each printer can accommodate a variety of papers. All will print on your own office stationery, as well as on fanfold "computer" paper, multipart forms, roll paper, and labels.

Each printer contains internal diagnostic tests that are performed automatically on power-up. Maintenance is easy. Without using tools, you can change your own ribbons and print heads and even install some options. The printers themselves are composed of modular subassemblies; this makes field service quick and economical.

The dot-matrix printers — The LA50 Personal Printer and Letterprinter 100 — both print descenders on all characters falling below the normal text line (y, g, j, q, p). And all of the printers give you both upper-case and lower-case letters, as well as many international letters and symbols.

LA50 Personal Printer

The LA50 Personal Printer is a desktop printer that adds flexible and inexpensive printing to your personal computer system.



Print Speed and Quality— This dot-matrix impact printer has two print modes: text mode and enhanced print mode. In text mode, it prints at 100 characters per second. The enhanced print quality mode prints 50 characters per second and creates a crisper, more uniform character than an ordinary dot-matrix printer. The seven-wire print head underlines text and prints descenders. It also prints double-width characters that are supported by the DIGITAL personal computer display screen and are especially good for headings. In addition, the LA50 Personal Printer prints full bit-map graphics at 144 x 72 dots per inch. The dots can be printed in the same way that the individual pixels are displayed on the video screen. Thus, high quality reproductions of video screen graphic designs can be printed.

Design Flexibility— With the LA50 Personal Printer you can choose the number of characters per inch or the number of lines per inch for each document. Tabs are spaced eight columns apart and you can adjust the forms length setting.

Paper Requirements— The LA50 can handle regular office or personal stationery up to ten inches wide. The tractor feed, which is standard, allows you to use fanfold paper. This printer also handles multipart forms up to a maximum forms thickness of 0.020 inch.

Font Flexibility— A multinational character set stored in read only memory is standard with the LA50 Personal Printer.

Communications— The LA50 Personal Printer comes with a standard EIA interface for direct connection to your personal computer. It's designed to be placed within easy reach of your personal computer.

Reliability and Maintainability— You can install the LA50 yourself; all of the connections are very straightforward. The LA50 provides the same reliability and maintainability of other DIGITAL printers. It is modular in design, which makes maintenance, when necessary, easy to perform. Self-tests and the Power-Up Diagnostic Test are included.

Whenever the power is turned on, the printer performs a number of operational checks. You can initiate a printing self-test any time, just by pressing the switch on the front panel.

Micro Spec



LA50 Personal Printer

Performance

Printing Speed:	100 char/s (text mode) 50 char/s (enhanced print mode)
Graphics Mode:	144 x 72 dots/in
Characters per Inch (char/in):	10, 12, or 16.5
Lines per Inch (line/in):	6, 8, or 12
Print Columns:	80, 96, or 132
International Character Set:	Standard
Buffer Capacity:	255 characters

Communications

Baud Rates in bits per second (b/s):	110 to 4,800
Interface:	ELA standard
Parity:	Odd, even, mark, or space 7 bits per character, selectable; Odd, even, or none 8 bits per character, selectable

Media

Paper Type:	Office Stationery, Fanfold
Paper Size:	
Maximum Width:	10 in (25.4 cm)
Maximum Paper Thickness (multipart forms):	0.020 in

Physical

Weight	20 lb (9.1 kg)
Height:	5 in (12.7 cm)
Width:	15.7 in (39.8 cm)
Depth:	11.2 in (28.5 cm)

Electrical

Power Consumption:	180 watts (maximum printing)
Voltage:	90 to 128 Vac 216 to 256 Vac
Frequency:	Range: 47 to 63 Hz
Power Cord Length:	6.6 ft (2 m)
Universal Power Supply (Switch-Selectable):	Not Available



Letterprinter 100

The Letterprinter 100 desktop printing terminal is a premium quality production-orientated printer with exceptional versatility.

Print Speed and Quality— This dot-matrix impact printer offers three user-selectable or program-selectable print speeds that provide high-speed text output, as well as letter-quality print. It can also be used to plot graphics and draw pictures. You can even combine text with graphics.

In the 240 characters per second (char/s) data processing mode, the Letterprinter 100 prints bidirectionally producing clear text. The optional 80 character per second memo mode utilizes a denser dot pattern for each character resulting in more clearly defined text. In the 30 character per second correspondence mode, the printer overlaps two sets of dots and thereby produces letter-quality text. The Letterprinter 100 can also be placed in graphics mode at any point under software control; this enables you to mix text and graphics on the same page. In graphics mode it prints 133 x 72 dots per inch (dots/in). This allows the Letterprinter 100 to faithfully reproduce graphic designs displayed on the personal computer's video terminal.

Document Design Flexibility— To give you maximum creativity in designing your document, you can tell the Letterprinter 100 how many characters per inch and how many lines per inch you require. With this printer, you can also select the margins, tabs and form length you need. The parameters can be stored in the Letterprinter 100's non-volatile memory, making the set-up for a series of documents a one-time job. The Letterprinter 100 features upper-case and lower-case characters as well as standard symbols.

Paper Requirements— The Letterprinter 100 uses regular office or personal stationery. It can also use roll paper or fanfold paper. It can even handle four-part forms, up to 0.020 inch thick.

Font Flexibility— For maximum versatility, the Letterprinter 100 features up to five internal typewriter-style character fonts. Courier-10 and Orator-10 style dot-matrix fonts are standard on all English language models. Three additional internal fonts (on read-only memory chips) can be field-installed should you require this printing capability. It is also possible to get this expandability by purchasing optional plug-in font cartridges. A maximum of two plug-in cartridges can be used at any time. Therefore, you can have five different character

fonts available for printing at any one time — either as five internal fonts or three internal and two external fonts. You can change the external fonts any time during page printing. When the typeface variety offered by the font options is combined with expanded/compressed character widths and graphics printing, it is easy to see that a large number of styles can be created. And any combination of styles can be contained within a report, page, or even a single line. National language sets are also available.

Communications— The Letterprinter 100 can support a variety of communication needs. The standard EIA interface allows local operation with your personal computer. An optional 20mA current loop will allow hard-wired operation of the printer up to 1,000 feet away from your personal computer. You can communicate with a printer in a remote location through an externally connected full-duplex modem option connected to a telephone line. The EIA modem cable for this operation is available from DIGITAL as an option. You can select the desired transmit and receive baud rates by pressing a switch.

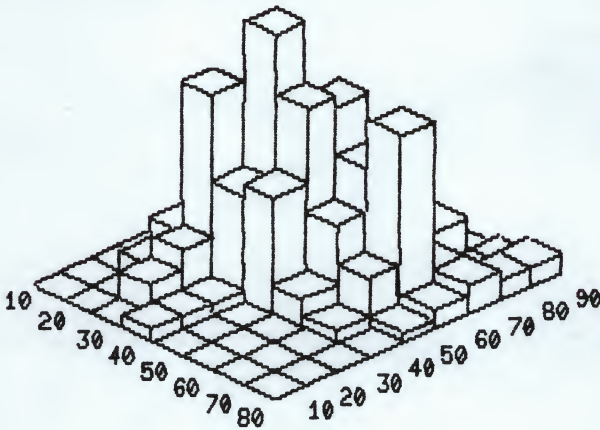
Reliability and Maintainability— When power is turned on, the Power-Up Diagnostic Test of the printer's microprocessor checks random access memory (RAM), read only memory (ROM), and the non-volatile memory for proper operation. Any failure is signalled by control panel indicator lights. The self-test modes permit rapid operational tests. Bell tone indicators sound when a buffer overflow or head jam occurs.

Although it requires no preventive maintenance, in the event that service is required, the printer is fully modular. Once the housing is removed, only four subassemblies need to be checked. Printheads can be replaced by the user in seconds. The snap-in cartridge ribbon is also user-replaceable.

Options— A full set of options is available so that the Letterprinter 100 can be tailored to your individual needs. The roll platen paper feed that accepts single sheets is standard with all models. An adjustable-width tractor feed, standard on some models and optional on others, handles fanfold paper and multipart forms. When purchased as an option, the tractor feed is user-installable. A roll paper holder and a low-paper roll detector are also available as options.

240 CPS DATA PRINTING
80 CPS MEMO PRINTING
30 CPS LETTER PRINTING
HIGH SPEED GRAPHICS

Versatile Printing
VERSATILE PRINTING
Versatile Printing
Versatile Printing
VERSATILE PRINTING
Versatile Printing



LETTERPRINTER 100

Micro Spec



Letterprinter 100

Performance

Printing Speed:	240 char/s (data mode) 80 char/s (optional memo mode) 30 char/s (correspondence mode)
Graphics:	132 x 72 dots/in
Characters per Inch (char/in):	5, 6, 6.6, 8.25, 10, 12, 13.2, or 16.5
Lines per Inch (line/in):	2, 3, 4, 6, 8, or 12
Print Columns:	66 – 217
International Character Set:	Available as option
Buffer Capacity:	400 characters 4K character option

Communications

Baud Rates in bits per seconds (b/s):	50 to 9600 Split speeds are available
Interface:	ELA standard 20mA option Parallel interface option
Parity:	Odd, even, mark, or space; 7 or 8 bits per character, selectable

Media

Paper Type:	Office Stationery, Rollpaper, Fanfold
Paper Size:	
Maximum Width	14.9 in (37.8 cm)
Minimum Width	3 in (7.6 cm)
Maximum Paper Thickness (multipart forms):	0.020 in

Physical

Weight:	25 lb (11.3 kg)
Height:	7 in (17.8)
Width:	22 in (55.9 cm)
Depth:	15.5 in (39.4 cm)

Electrical

Power Consumption:	55 Watts (maximum printing)
Voltage:	87 to 128 Vac 174 to 256 Vac
Frequency:	Range: 47 to 63 Hz
Power Cord Length:	8 ft (2.4 m)
Universal Power Supply (Switch-Selectable):	Yes

LQP02 Letter-Quality Printer

The LQP02 Letter-Quality Printer is a formed character, desktop printer incorporating daisywheel technology. It features excellent print quality and reliability over continuous use. This makes it ideal for word processing applications.

Print Speed and Quality— This printer has a speed of 32 characters per second. Because it uses a daisywheel print head, the LQP02 produces full-character printing. It also uses the bidirectional technique to save print time. The LQP02 provides a new feature, called "shadow bolding," in which characters are struck twice, as in normal bold print. But unlike normal bolding, the second strike is slightly offset from the first. The advantage of this process is that the bold print is much more visible, ensuring that the bolding will be retained when an original is photocopied.

Design Flexibility— The LQP02 offers software-controlled variable pitch, as well as the standard 10 and 12 characters per inch. Software controlled pitch allows you to select the spacing between lines (vertical pitch) and the amount of space that each character will occupy (horizontal pitch). The LQP02 gives you even more flexibility than a standard office typewriter in selecting the spacing and the print density. It offers software-controlled variable pitches, you can vary the space allotted to each character. Margins, tabs and length setting are all adjustable. The LQP02 printer also features upper-case and lower-case characters and standard symbols.

Paper Requirements— This letter-quality printer handles regular office stationery up to a maximum width of 15 inches, but the print capacity is 13.5 inches. If the optional forms tractor is purchased, the LQP02 can handle fanfold paper. It can also handle multipart forms, up to a thickness of 0.025 inch.

Font Flexibility— The LQP02 offers over 100 character sets, including English-language or National language character sets. A variety of type styles are also available, such as Courier, Pica, Letter Gothic, Prestige Elite, and Orator.

Communications— EIA interfaces allowing local operation are standard with the LQP02 printer. The printer can be connected remotely through modems. Baud rates are switch-selectable.

Reliability and Maintainability— You can install the LQP02 yourself and easily replace the print head and the cartridge. It is modular in

design, which makes maintenance, when necessary, easy to perform. Self-tests as well as the Power-Up Diagnostic Test are included. Whenever the power is turned on, the printer performs a number of operational checks.

Options— A full set of options is available to tailor this letter-quality printer to your special needs. The sheet folder option gives the LQP02 the ability to handle pre-printed letterhead automatically. The forms tractor permits the handling of fanfold paper. The sheet feeder and forms tractor can both trigger a visual and an audible paper-out indicator that lets you know when the printer has run out of paper.

Value and Performance in Personal Computers

DIGITAL's personal computers give you three powerful systems to choose from. You can select personal computing on the Rainbow 100, a dedicated word processing with DECmate II, or advanced business and engineering capabilities with the Professional 325 and 350. All of DIGITAL's personal computers have powerful processors, large memory and storage capacities, terminal emulation capability, and the ability to transfer files to and from other computers. These features let a DIGITAL personal computer give you a maximum number of applications with a minimum of hardware. In addition, you get the comfortable and efficient use that is the result of extensive ergonomic design. There is also the full line of national language features that insures that wherever you are, one of these systems will be ideally suited to your personal computing needs.

Micro Spec



LQP02 Letter-Quality Printer

Performance

Printing Speed:	32 char/s (letter-quality)
Characters per Inch (char/in):	Software-selectable, 10/12
Lines per Inch (line/in):	Software-selectable, 2/3/4/6/8
Print Columns:	132 at 10 char/in 158 at 12 char/in
International Character Set:	Available as option
Buffer Capacity:	256 characters

Communications

Baud Rates in bits per seconds (b/s):	110 to 9,600 Split speeds are also available
Interface:	EIA standard
Parity:	Odd, even, mark, or space; 7 bits per character, selectable

Media

Paper Type:	Office Stationery, Fanfold
Paper Size:	
Maximum Width:	15 in (39.1 cm)
Maximum Paper Thickness (multipart forms):	0.025 in

Physical

Weight:	48 lb (21.8 kg)
Height:	7 in (17.8 cm)
Width:	28 in (71.1 cm)
Depth:	16 in (40.6 cm)

Electrical

Power Consumption:	120 watts, average
Voltage:	90 to 128 Vac 191 to 256 Vac
Frequency:	Range: 47 to 63 Hz
Power Cord Length:	6.3 ft (2 m)
Universal Power Supply (switch-selectable)	Yes



Chapter 4

The Rainbow 100

The Rainbow 100

DIGITAL's Rainbow 100 is a high-performance personal computer that will run a very wide selection of low-cost CP/M-based and other industry-available software. It will execute 8-bit and 16-bit programs based on CP/M 80, CP/M 86, and MSTM/DOS. Thousands of these programs are already available for personal computers. The applications range from personal productivity tools to a large variety of generalized and profession-specific business programs. The Rainbow 100 gives you access to this large collection of personal computing software.

DIGITAL's Rainbow 100 contains two processors — an 8-bit Z80 and a 16-bit 8088. The two processors divide system functions — reading or writing to disk is controlled by the Z80, while the video display, keyboard, input/output port and the options are controlled by the 8088. Both processors share 64 Kbytes of main memory. The parallel processing that this arrangement provides makes the Rainbow 100 an exceptionally fast and powerful computer.

In addition to performance enhancements, the dual-processor system let DIGITAL create a hybrid 8-bit CP/M 80 and 16-bit CP/M 86 operating system called CP/M 86/80. This implementation of CP/M features a capability called "soft sense" which allows CP/M 80 and CP/M 86 application programs to run on the Rainbow 100 without operator intervention. The CP/M 86/80 operating system automatically determines if the application is an 8-bit or 16-bit program and executes the instructions with the appropriate processor and operating system subset.

The Rainbow 100 comes with 64 Kbytes of main memory and it can be expanded to 128 or 256 Kbytes. The standard dual diskette drive holds 800 Kbytes of on-line auxiliary memory on two 5¼-inch diskettes. A second disk drive can be added to bring total on-line storage to 1.6 Mbytes.

Rainbow 100 features a built-in asynchronous/byte synchronous communications port that supports telephone modems. Modems are used to communicate with other computers over telephone lines. This is a very convenient way to connect your Rainbow 100 to subscription information services or to remote computers through terminal emulation.

The Rainbow 100 is also equipped with a standard printer port. The printer port supports any of the three printers that are available for DIGITAL's personal computers. Rainbow 100's printer port accommodates RS-232C industry-standard lines and features programmable baud rates for selecting the speed at which files are transmitted to the printer.

The Rainbow 100's self-diagnostics let you know when a component needs to be checked. The diagnostics not only tell you that there is a problem, they also isolate the problem area for you. Diagnostics are initiated automatically on power-up and perform extensive checks on the communications, video, and diskette-drive circuits. Using a "loop-back" testing technique, they ensure that all the major components are operating properly.

Diagnostic error messages are displayed on the display screen in plain text. Lights on the keyboard are also used with the self-diagnostics routines to display error conditions.

Other options for the Rainbow 100 include a monochrome and colour bit-mapped graphics option and an extended communications option. The extended communications option provides an additional communications line to other computers, direct memory access (DMA) over all communications lines, and a high-speed communication line. The high-speed line can be connected to an optional Winchester disk. The Winchester disk option is mounted externally in a separate cabinet and provides an additional five Mbytes of fast-access on-line storage.

The Rainbow 100 comes complete with dual processors, VT100 video attributes, communications and printer-port, 64 Kbytes of main memory and a dual diskette drive.



The Rainbow 100 is a high-performance computer that is ideal for low-cost 8-bit and 16-bit CP/M software.

The CP/M Software Environment

CP/M — Control Program for Microcomputers — is characterized as a single-task, diskette-based operating environment that is well-suited to low-cost personal computer hardware. First developed in 1974, CP/M was one of the first disk operating systems not designed for a particular personal computer. It was hardware-independent. Prior to the availability of CP/M, application software had to be significantly changed to run on another manufacturer's personal computer. Often this limited the capabilities and availability of programs.

CP/M provides basic computer services. It is perhaps best known for its simple and reliable file system used with diskettes. It has been im-

proved and rewritten over the years as faster, more reliable diskette drives were introduced. At the same time that disk technology was improving, new 16-bit microprocessors were being introduced into low-cost personal computers. In response to the arrival of these microprocessors new versions of CP/M were written to take advantage of their increased performance.

The widespread acceptance of CP/M software has resulted in numerous software vendors offering thousands of ready-to-run CP/M application programs. The great majority of these applications are designed to run on 8088-based or Z80-based personal computers. Since the Rainbow 100 contains both microprocessors it can run 8088-based or Z80-based CP/M software.

Rainbow 100 Software

The library of CP/M programs and other industry-available programs for the Rainbow 100 is very extensive and is growing all the time. The most current information is available in a personal computer software catalogue from Digital Equipment Corporation. Among the most popular programs for this computer are those for spreadsheet forecasting, easy word processing, and the BASIC programming language. The following is a brief description of the capabilities of these programs.

The Rainbow 100 Spreadsheet Planning Program

This powerful financial planning tool turns your display screen into an "electronic blackboard" on which you can lay out a table of values and formulas for combining these values. When you alter one value, the program automatically changes all related ones—individual cells, full rows, full columns, or whatever groupings you've set up. This allows you to pose any number of "what if" questions and see instant answers on the video screen. You can use the spreadsheet program in most management and decision-making situations — forecasting, hypothesizing, capital management, planning, tracking, production management — any place you'd normally draw up a spreadsheet.

The spreadsheet program lets you work with an array of data 63 columns wide, 255 rows deep and several pages thick. You can display a full 132 characters per line on the Rainbow 100, so you can scan many columns at the same time. Or you can compare up to eight groups of cells head-to-head with the "window" feature. You can assign meaningful names to cells or groups of cells, like "sales" or "first

quarter," then refer to those names in all future formulas. You can store worksheets and reference the values stored on them, even though you're not currently displaying them.

In short, anything you can do with pencil, paper and calculator, you can do with the spreadsheet program — only much more quickly and accurately, because the program automatically does all the calculations and cell updating for you. And the spreadsheet program has extensive screen messages, a menu of commands, a help file you can access at any time, and straightforward rules of operation, so you can start doing productive work in an afternoon.

The Rainbow 100 Word Processing Program

The Rainbow 100 word processing program is ideal for managerial use in the preparation of memos, letters and reports. This personal word processing program combines a set of the more powerful and popular word processing functions with a unique self-teaching approach that lets you start using the program almost immediately. You learn how to use this program directly on the computer by running its built-in teaching function and following its instructions on the display screen. You can also get "refreshers" in the midst of working by calling a help function.

This word processing program lets you avoid memorizing involved commands and control codes; its commands consist of single letters and menu choices. The size of a document you create with the program is limited only by the size of your storage disk. Disk-overflow protection and automatic back up file maintenance protect your text as you work. Other features include:

- **Global Replace**— The word processing program can automatically check through an entire document, replacing every occurrence of a given word or phrase with a new one. It then automatically realigns and rejustifies the entire document in a matter of seconds.
- **Merge Printing**— This function keeps track of mailing lists of any length and lets you merge them in with form letters of your devising. You write one version of a letter, then have the merge printing function type out an individual copy to each name on your list. It will automatically change the inside address, the salutation, and any other personalized text you've included. You can print handsomely formatted mailing labels too.

- **Formatting features**— The word processing program allows you to position segments of text — left, right, and center — and set margins and tabs.
- **Compatibility features**— The word processing program can directly edit spreadsheet reports generated by the Rainbow 100 spreadsheet program and allows those reports to be included in other documents. Also, Rainbow 100 word processing documents can be transmitted to other computers with Rainbow 100 communications software.
- **Multiple uses**— Rainbow 100 word processing has a special “programmers mode” that is used to edit source files for programming languages. All of the powerful features of the word processing program are available in this mode.

The Rainbow 100 BASIC Programming Language

The BASIC for the Rainbow 100 is a full-feature implementation of this popular programming language. It is easy to use and has the kind of performance you’d expect from software running on much larger machines.

This BASIC, which meets the requirements for the ANSI subset standard for BASIC, includes many additional features rarely found in other implementations of the language. Among those it supports are:

- **Long variable names**— Variable names can have up to 40 characters, so you can make them as descriptive and “self-documenting” as you require.
- **Protected files**— Disk files can be saved in a coded binary format and protected with a password. This is handy for building software that manipulates sensitive data, such as payroll and financial information.
- **Dynamic-string space allocation**— There is no need to allocate extra space for “string” or text data. This feature lets you conserve memory space and create a more compact program.
- **Block-programming statements**— WHILE/END, IF/THEN/ELSE, and nested IF/THEN/ELSE statements let you use modern structured programming techniques in your programs.
- **CHAIN and COMMON statements**— These statements

allow your programs to be linked together and to share common variables.

- **Helpful debugging and editing features**— Trace facilities, error trapping, an EDIT command plus edit-mode subcommands, and automatic line-number generation and renumbering help automate your program writing and debugging.

These, plus a rich vocabulary of program statements and functions, make this BASIC a powerful tool for creating software applications.

Rainbow 100 Communications Software

The Rainbow 100 communications software allows your Rainbow 100 to operate as a terminal to a host computer system and to transfer files, both between Rainbow 100s and between a Rainbow 100 and a host.

The communications software functions include:

- **Terminal Emulation**— The Rainbow 100 communications program allows the Rainbow 100 to be connected to a host computer through a local or telephone line connection and operate as a VT100 video terminal or a VT125 graphics terminal.
- **File Transfer**— The communications software also provides two data file transfer modes — CX (character transmission) and DX (document transmission) — to move files to and from other computers, including other Rainbow 100s, over local connections or to remote systems over telephone lines.

Rainbow 100 Options

It is very easy to add additional features to the Rainbow 100. Most of them are available on option boards that plug into designated locations on the system board or system module. The system board supports three option boards.

Additional main memory is available on 64 Kbyte or 192 Kbyte option boards that let you expand the Rainbow 100's memory to a maximum of 256 Kbytes.

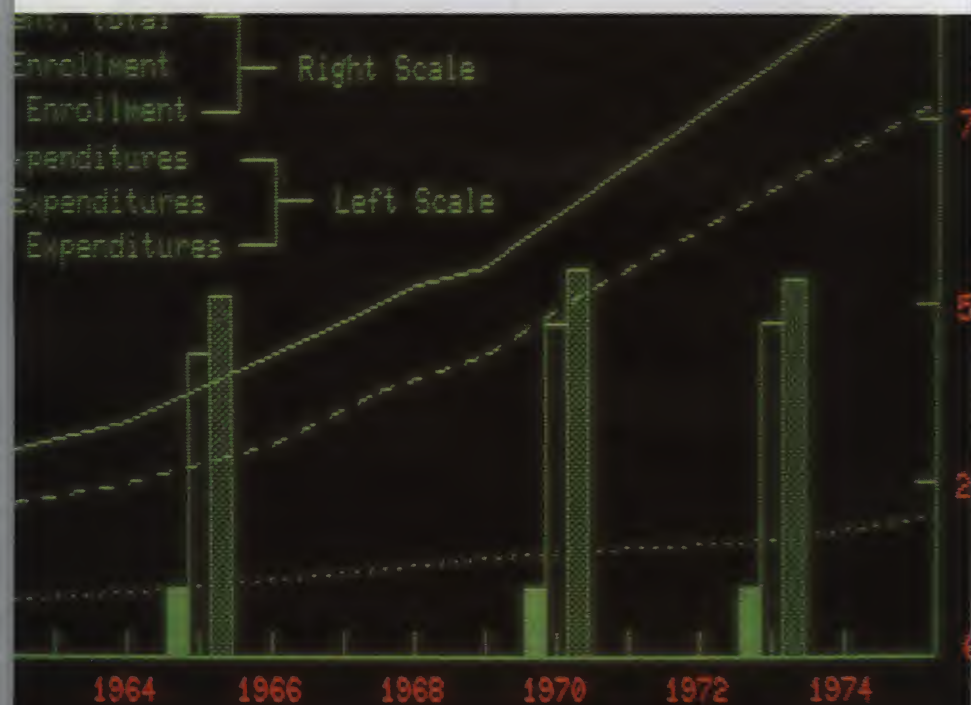
An extended communications option is also available that gives you an additional communications port and a high-speed disk interface port to use with the external Winchester disk option. The Winchester disk option is housed in a separate cabinet and provides an additional five Mbytes of on-line, fast access auxiliary memory.

Graphics Capability

Graphic displays are very useful for comparing data that has been gathered over a period of time or for comparing relative sizes of a collection of data for quick analysis. You can use graphics software to display bar and pie charts, graphs or tables for your personal finance and business applications.

The Rainbow 100 offers graphics capability on a bit-mapped/colour graphics option board. This option gives the Rainbow 100 the graphics capabilities found in DIGITAL's high-performance VT125 graphics terminal. It equips your personal computer with high resolution, bit-mapped monochrome and colour graphics capability. With graphics software you can generate all of your graphics on the Rainbow 100 itself. The graphics option has two resolution modes. The high resolution mode — 800 pixels by 240 pixels — provides precise bit-mapped graphic displays, and the low resolution mode — 320 pixels by 240 pixels — provides television quality graphics support as well as support for future video text communications.

The Rainbow 100 provides optional high-resolution bit-mapped colour graphics.



Using VT125 emulation software, the Rainbow 100 will execute DIGITAL's ReGIS™ Remote Graphics Instruction Set. ReGIS is designed to send and store graphics data and text efficiently in standard ASCII files. You can use ReGIS files to communicate graphics information to other computers, either through a local connection or over a phone line via modems. This allows you to emulate DIGITAL's popular VT125 graphics terminal.



Rainbow 100

Optional Colour/Graphics Features

Type:	Bit-Mapped
Resolution:	Two Modes
High Resolution	800 x 240 Picture Elements (pixels) 2 planes
Low Resolution	320 x 240 pixels 4 planes
Number of Colours Displayed:	
High Resolution	4 from a palette of 8
Low Resolution	16 simultaneously
Graphics Language:	VT125 Terminal Emulation Capability High Level Language Extensions
Scrolling Capabilities:	Yes Horizontal and Vertical
Split Screen:	Yes Horizontal and Vertical

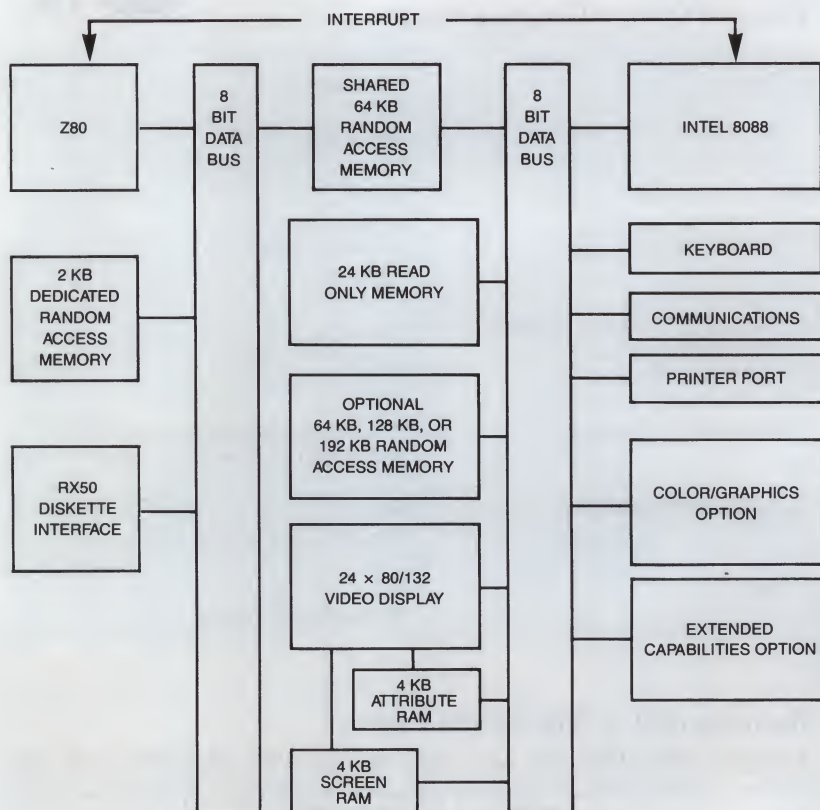
Rainbow 100 — The CP/M Expert

Rainbow 100 offers the user high performance, flexibility, and the ability to run a broad range of personal computer applications. With Rainbow 100, you don't have to choose between an 8-bit or 16-bit personal computer. Rainbow 100's dual-processors run both proven 8-bit and sophisticated 16-bit applications on the same machine, and

they share I/O tasks for a significant performance advantage over single-processor personal computers.

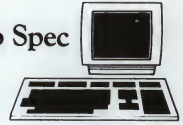
Rainbow 100 offers an 800 Kbyte dual diskette drive, a high-quality keyboard and display-screen, and 64 Kbytes of memory as standard features. With additions such as the extended communications option, bit-map colour graphics, and terminal emulation and file transfer software, Rainbow 100 provides even more computing performance.

Below is a summary of technical information for the Rainbow 100. The system block diagram outlines design architecture, while the Micro Spec summarizes standard and optional features.



Rainbow 100 System Block Diagram

Micro Spec



Rainbow 100 System Summary

Standard System:	System unit, keyboard, display screen, and operating system
System Unit:	Small box
CPU	Z80/8088 dual microprocessors
Memory	64 Kbytes
Printer Port	Serial, RS232
Communications Port	Asynch/synch, up to 9,600 baud with modem control
Storage	Dual diskette drive (2 x 400 Kbytes)
Video Output:	Monochrome, RS170 Compatible
Operating System:	CP/M-86/80 Software
System Expansion:	Three dedicated slots for option boards User-installable

Hardware Options:

- External 5 Mbyte Winchester disk drive
- Bit-map colour graphic option
- Additional memory in 64 Kbyte or 192 Kbyte increments up to a maximum of 256 Kbytes
- Second dual diskett drive (2 x 400 Kbytes)
- Extended communications option — two additional communications ports (RS232, RS422)
- Choice of LA50 Personal Printer, Letterprinter 100, or LQP02 Letter Quality Printer
- System unit stand for vertical floor mounting



The Professional 325 and the Professional 350

The Professionals — A New Generation

DIGITAL's Professional 325 and Professional 350 were designed for a new generation of personal computer software. DIGITAL has developed a new operating system for the Professionals that gives them the ability to execute many different computing tasks simultaneously. The operating system also contains a sophisticated file-managing ability — compatible with larger DIGITAL minicomputers — as well as a multiple communications capability. This computing power used to be found only on larger minicomputers but it is now available on a personal computer. The Professionals are able to work interactively at the same time that they are printing, communicating with another computer, or performing other tasks.

Equally important is the fact that these computers are easy to use. Ease of use is an integral part of DIGITAL's new Professional Operating System (P/OS). A standard menu structure guides you through every step of running application software and managing the computer's resources. The "menu tree" lets you access any of the computer's programs or services quickly. And built into the operating system is an on-line help feature that gives you additional information at the touch of a key.

The Professional 325 and 350 contain a 16-bit PDP-11 minicomputer and they both include 256 Kbytes of main memory. Each system includes a diskette drive with 800 Kbytes of storage capacity on two 5-1/4-inch diskettes.

If there is a problem during power-up, the Professionals contain extensive self-diagnostics, and a message will be sent to the screen pin-pointing the source of the problem. The Professionals have even been designed to display a picture of your personal computer with the problem components highlighted.

The Professionals also provide an exceptionally high-quality graphics capability as a standard feature. This is made possible through their integral bit-map video controller that supports 960 horizontal by 240

vertical pixels on the displayscreen. Graphics are implemented through an interface between the application program and graphics support software that conforms to the CORE conventions. CORE is a proposal supported by the ACM Special Interest Group on Graphics (ACM-SIGGRAPH). CORE is significant because of its modular approach to programming and its standard interface format that is not dependent on a particular graphics output device. Extensions have been added to the Professional's graphics capability that include rectangles, circles, arcs and interpolated curves. The end user can program graphics using the Professional BASIC programming language and the appropriate graphics subroutine calls.

Both Professional models include an easy-to-use memo editor on either diskette-based or Winchester disk-based systems. Within minutes of installing the software, you can put the Professional to use preparing memos and other documents. The memo editor is able to relocate text within a document, delete text, duplicate text within a document, find a word or sentence, and replace it with other text.

The Professional 325 system unit will accommodate one of the Professional options. The Professional 350 system board provides four slots for system expansion. In addition, the slightly larger system unit for the Professional 350 has a larger power supply that allows you to house a five Mbyte Winchester disk internally. Along with the Winchester disk option comes DIGITAL's complete hard disk resident multi-tasking operating system. With this version of the Professional's operating system you can leave many of your application programs



installed on your computer. The main advantage of the Winchester disk option on the Professional 350 is that you can use the full capabilities of the multi-tasking operating system. Having many programs loaded into the system at the same time lets you do a great deal of concurrent processing.

Other options that are available for the Professionals are:

Extended bit-map option — with high-resolution, bit-mapped colour graphics displays eight colours at a time from a palette of 256.

Telephone Management System — (available for the Professional 350 only) accommodates two telephone lines — one for voice and one for data transfer; an integral modem; and a voice unit that contains a speaker and microphone, a telephone keypad, and voice function keys.

Floating-point adapter — performs precision arithmetic calculations at very high speed for applications that require extensive data processing.

Communications software — lets you transfer files to larger DIGITAL minicomputers or other Professionals and that includes VT-100 family terminal-emulation capability. This same software also supports the telephone management system and provides auto dial/auto answer telephone control and maintains the communications phone book.

BASIC programming language — one of the most popular standard programming languages. You can write, debug and run your own BASIC programs on your Professional; control screen colours; and generate graphics.

Major Features of The Professional Operating System

The Professional Operating System gives you a generous collection of services and capabilities—complete file, disk/diskette, printer, and communications services—the kind found on very sophisticated minicomputer systems. These services allow you to keep your files organized and up-to-date, and they let you run your application programs efficiently.

The Professional 350 with advanced multi-tasking and communications features. From left-to-right: (top) — system unit and Letterprinter 100. (bottom) — Telephone Management System, video display and keyboard.

The following services are available on DIGITAL's Professional 325 and 350.

- Menu for selecting the services and applications that you might want to run.
- A help service that displays useful information when you want it.
- File services for manipulating, organizing and providing up-to-date file information.
- Disk and diskette services for copying, naming and erasing diskettes.
- An editor service that allows you to easily create and edit text.
- A print service for printing documents when an optional printer is connected to your personal computer.
- A message/status board that allows you to read messages generated by your personal computer and your applications programs.
- An additional applications service for the Professional 350 that organizes and accesses applications installed on the Winchester hard disk.

A Family of Software

DIGITAL's popular RSX-11M-PLUS minicomputer operating system was incorporated into our Professional Operating System. In addition, the microprocessor used by the Professional 325 and 350 is the same one used in our PDP-11/23 minicomputer. With this combination of hardware and software, you get true minicomputer performance with a desktop-sized personal computer.

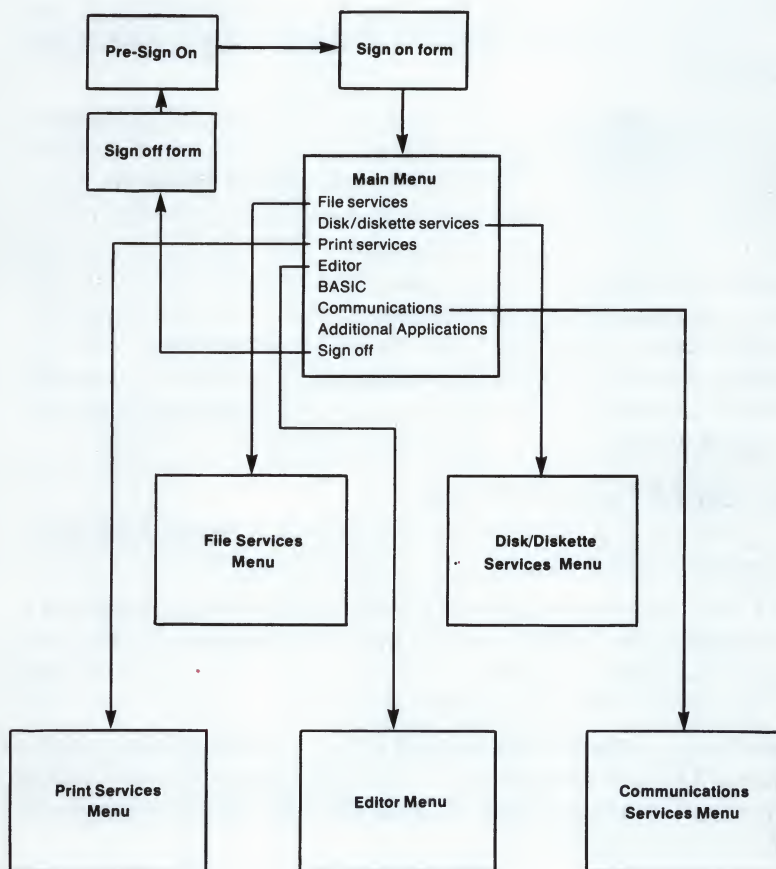
You also benefit from DIGITAL's software family. As a member of DIGITAL's PDP-11 family, the Professional shares a common file structure with DIGITAL's VAX-11. The Professional 325 and 350 personal computers can transfer files to other computers running DIGITAL's RSX-11M, RSX-11M-PLUS and VAX/VMS software. To do this, you need the optional communications software installed in your personal computer and the other computer system.

Being a member of the software family also means that applications for the Professionals can be developed on a host system and then transferred to a Professional 350 personal computer for debugging. DIGITAL's special software development Toolkit allows programmers to use the extensive facilities of their host computer to develop Professional applications for you.

The Menu Tree

The main menu displays system services that are available for your use. It also lists application programs that are resident on the diskette or on the Winchester disk. The "arrow keys" on the keyboard position the selector at the desired item. You can also type in characters that correspond to the highlighted portion of the line item. You use whichever selection method you prefer.

There is room on the main menu to list several of your frequently used applications. Your other installed but less frequently used applications are listed on series of other secondary menus. These menus appear when you select "Additional Applications" from the main menu.



After you select an item from the main menu, the next menu appears on your display screen listing the various functions that you can perform. Once again, you simply choose the desired function by moving the selector or by typing in a few characters.

Some services may require you to view more than one screen to display all the available functions. For example, choosing "Additional Applications" from the main menu might generate several other menus, depending on how many applications you have installed. There are 11 screens available for additional applications menus so you can organize your applications into different categories.

There are two types of menus: single-choice and multiple-choice menus. The single-choice menu has already been described above. The difference between it and a multiple-choice menu is that it lets you mark several items at a time, using the selector and "SELECT" key. When you press the "DO" key, your choices are all executed by the personal computer.

The menu tree feature on the Professional 325 and 350 gives you a variety of timesaving benefits and provides you with quick access to system services and installed applications. Menu selections act as commands for the personal computer. As a result, you don't have to learn a special command language. The operating system's multiple-task capability also saves time. For example, you can edit a file while simultaneously transferring information to another computer. Multiple-choice menus save you time by eliminating repetitive selections. Finally, by organizing installed applications into 11 separate groupings, you have a convenient structure for listing and organizing your applications.

The "HELP" and "DO" Keys

On-line help is available when you are using the Professionals. To get it, you press the "HELP" key.

HELP is context-sensitive. If the selector is positioned at the top of a menu screen, the "HELP" key will provide information on the total menu. If the selector is positioned at a particular line, HELP will give you information about that particular function.

To eliminate confusion and possible errors, DIGITAL chose to use a separate "DO" key for getting new screens and sending commands to the personal computer. When you press the "DO" key, whatever you've

entered on the display screen is processed by the personal computer. You're basically telling the personal computer to "do this" or "execute that command." Many personal computers label this function RETURN. RETURN, however, actually refers to the carriage return function of a typewriter that starts a new line. RETURN has little to do with telling the personal computer to execute a command. Combining these two functions in one key can be confusing.

Other Function Keys

In addition to making selections from the menu screens, you can call additional functions by pressing special function keys. These keys, which are located across the top of the keyboard, have a label-strip above them that clearly indicates their purpose. The keys help you to use the system services and to control the resources of your personal computer. The function keys are summarized below.

- **HOLD SCREEN**— Stops the scrolling process and holds the current information on the screen. This is especially useful when complete files are being transmitted to you quickly.
- **EXIT**— Lets you exit from a particular service at any time.
- **SET-UP**— Displays the Set-up Menu that lets you set the characteristics of the display screen and keyboard — column width, reverse video, and keyclick sound level, for example.
- **INTERRUPT**— When followed by the "DO" key, cancels the current function and displays the main menu.
- **DO**— Executes a menu choice or command usually causing the screen to change.
- **PRINT SCREEN**— Sends a copy of the screen contents to a printer. You can get a copy of a graphics display if you have a graphics printer.
- **MAIN SCREEN**— Causes the main menu to be displayed if you are in the menu tree.
- **CANCEL**— Tells the personal computer not to execute a menu choice or command that has been keyed but not sent by the "DO" key.
- **ADTNL OPTNS**— Displays the Additional Options menu, from which you can select a variety of functions.

- **COMPOSE CHARACTER**— Allows you to display many international characters and symbols on the screen.
- **PREVIOUS SCREEN** — Displays previous screen of text or the next higher-level menu (if you're using the menu tree).
- **NEXT SCREEN**— Causes the next screen of information to be displayed, depending on what service you're in.

Message Status Board

The message status board is another example of the quality and convenience of the user service DIGITAL's Professional 325 and 350 personal computers provide. The message status board displays system status information and other messages in one convenient location. Usually only one screen will be required to display all the information but extra screens are generated if the contents of the message status board require them.

The top half of the message status board gives you current information on the services being used and on disk status. The bottom half of the board displays one-line messages sent by a service or application. The ability of applications to send you messages is significant. The program can send certain messages to the message status board while your application is running. These messages could keep you posted on the application's status or could remind you to perform other tasks.

Whenever a message is placed on the message status board the keyboard "beeps," regardless of what you're doing on your personal computer. To view the message, you first must exit from the service or application that you're working in. The main menu will appear. You then select "MESSAGE/STATUS" from the main menu, press the "DO" key, and read your message from the message status board screen.

Installing the Professional Operating System

The Professional Operating System is available in two versions — a diskette version and a Winchester disk version.

Diskette-based software can be run on DIGITAL's Professional 325 or 350 models and includes file, disk and print services. Winchester-based software runs only on the Professional 350 and requires the optional Winchester disk drive. The operating system includes file, disk, and print services and the text editor. Initially, this software is supplied to you on several diskettes. The software on the diskettes is copied only

once onto the Winchester disk, during the installation process. The actual installation procedure is quite straightforward. A series of questions and prompts guides you through the whole process.

Advantages of Winchester-Based Software

The Professional 350's Winchester-based software gives you many advantages. Winchester disks are noticeably faster than diskette drives because they can access and transfer characters to your personal computer's memory at a higher speed.

You don't need to insert a system diskette every time you use your personal computer. The operating system and your application software remain on the disk. Moreover, the huge capacity of the hard disk gives you room to simultaneously store many application programs. This leaves the personal computer's diskette completely free for additional storage, expanding overall data and system flexibility.

With Winchester-based software, your applications are completely integrated into the Professional 350 system. You can access applications by making a menu selection. Depending on the amount of disk space they require, all of your applications can be stored on the Winchester disk. Since the Winchester disk storage capacity is roughly ten times larger than the diskette drive, larger programmes and data files can be maintained.

Professional BASIC

Professional BASIC allows you to write programs on your Professional personal computer. It provides many functions not ordinarily available with personal computer BASIC. For instance, you can control the screen colour and directly access the advanced bit-mapped graphics capabilities of the Professionals. This BASIC includes instructions to:

- Move the cursor to any pixel position
- Draw lines and curves
- Use alternate character fonts
- Control character size, angle, and spacing
- Control the colour map

Professional BASIC also provides on-line HELP, performs immediate syntax checking, identifies errors and provides immediate feedback. Built into Professional BASIC is a single-line editor that uses the arrow keys of the editing keypad and the insert and delete keys.

Professional BASIC is an interpretive language with no need for compilation or linkage. Its debugging tools include. Trace Mode; Step Mode; and Show, which displays all variables used, their values, the program size, the number of lines and the amount of free memory. Other features include:

- Virtual arrays — provides random access to a file.
- Dynamic dimensioning of arrays — provides the ability to change the size of an array during execution.
- Error handling — lets the program detect, report and recover from execution errors.
- Extended mathematical capabilities — includes absolute values, cosine, log, pi, sine, square root and double-precision support.
- Long variable names (up to 31 characters).
- String functions.

Professional Communications Software

The Professional communications software allows your Professional to operate as a terminal to a host computer system and to transfer files, both between Professionals and between a Professional and a host. This support is provided for the standard communication port in asynchronous mode and for the optional telephone management system.

The communications software functions are selected from menus. They include:

Terminal-emulation mode— In this emulation mode your Professional can be connected to a host computer through a local or telephone line connection and operate as a VT52/VT102 video terminal or VT125 graphics terminal.

File transfer— Binary and ASCII files can be transferred between one Professional and another. In addition, files can be copied or received by one of the Professionals without intervention. Password protection prevents unauthorized access, and copying controls keep transferred files from superseding existing ones. Files can be

transferred between a Professional and a VAX/VMS, RSX-11M or RSX-11M-PLUS host by invoking a file transfer task on the host.

Professional phonebook file— The phone book file allows you to maintain a directory of names, phone numbers and line characteristics for commonly called numbers. Automatic connection with other computers is possible with the telephone management system or a modem.

Set communications characteristics— Communications characteristics for each different computer your Professional communicates with can be set and stored in the Professional phonebook file along with the phone numbers of computers contacted over telephone lines.

The Telephone Management System (TMS)

The Telephone Management System for Professional 350 is designed to make all of your communications more efficient. There is a great need to transfer information to people over the telephone. Some of this information is best conveyed as conversations and some is best conveyed as text and data. TMS can pull all of these important communications together through your personal computer.

The Telephone Management System, which is supported by the Professional communications software, gives you the capability to:

Auto dial from a telephone directory— TMS supports the Professional phone book. You simply enter the name and the Professional 350 places the call automatically. If the line is busy, it will dial again until the connection is made. The Telephone Management System already contains the modems necessary for computer-to-computer communications so the same automatic dialing can be used.

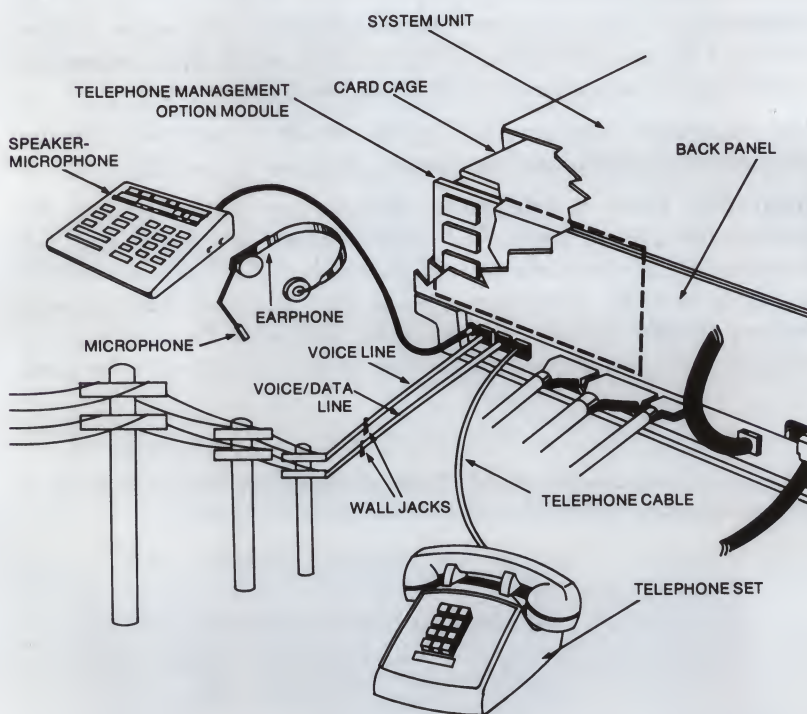
The speaker/microphone keypad of the Telephone Management System (shown left) is designed to balance and blend with the Personal Computer keyboard).



You just enter the name given to the computer and the Professional will dial the number and make the connection. It will even use the set of communications characteristics stored in the phonebook file to prepare for transmission. This is an excellent way to connect to computer-to-computer information services.

Transmit simultaneously over two phone lines— Two telephone lines can be connected to the Professional 350. One can handle voice conversations, while you are transmitting data to another computer over the second line.

Conference calling— The TMS voice unit comes with a speaker and microphone for hands-free operation. This capability can also be used to bring several people into a telephone conversation for a conference call.



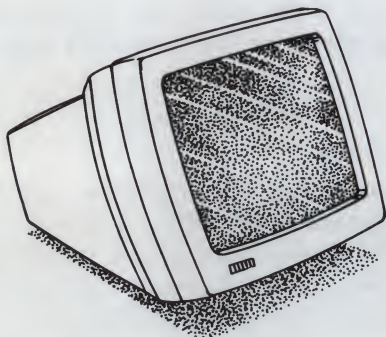
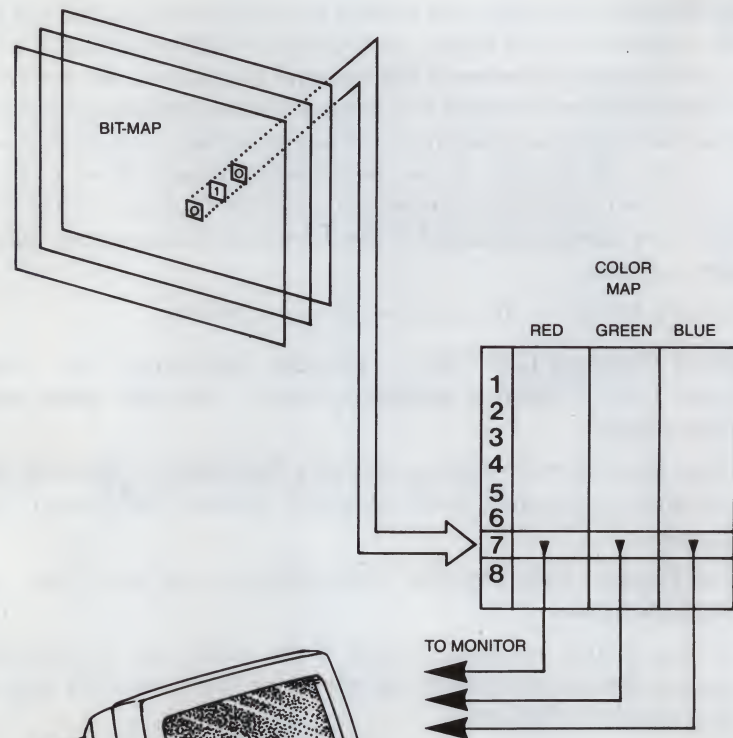
The Professional 350 Telephone Management System interconnections.

The Telephone Management System has even more capability. It has been designed for the future with hardware that will improve all of your office communications. TMS contains, for instance, the hardware to digitize voice and transfer it to memory. It also contains a touchtone transceiver to send and receive touchtone telephone signals. Software developers will be able to use these hardware capabilities to bring exciting new communications resources to your Professional 350. This hardware is already contained in the Telephone Management System option module:

- Integral Modem — Transmits at 300 and 1,200 baud
- Voice Digitizing (CODEC) — Encodes and decodes voice from either one of the two telephone lines or from the voice unit's microphone.
- Dual-Tone Multi-Frequency (DTMF) Decoding — Receives and transmits commands from standard remote pushbutton telephones.
- Call Progress Tone Detector — for detecting dial tone, busy, and ringback signals.
- Analog Switch — connects any of the Telephone Management System devices to either of the telephone lines, the voice unit, or your telephone handset.

The Extended Bit-Map Option

Each Professional is already equipped with extensive graphics capabilities. The standard video generator supports one plane of 960 by 240 independently bit-mapped pixels on the display screen. The Extended Bit-Map Option adds two additional bit-map planes of 960 by 240 pixels each. It also provides a colour map that interfaces to the bit-map, giving you the ability to simultaneously display eight colours from a palette of 256, or, with a monochrome display, eight shades of grey.



Extended Bit-Mapped Option

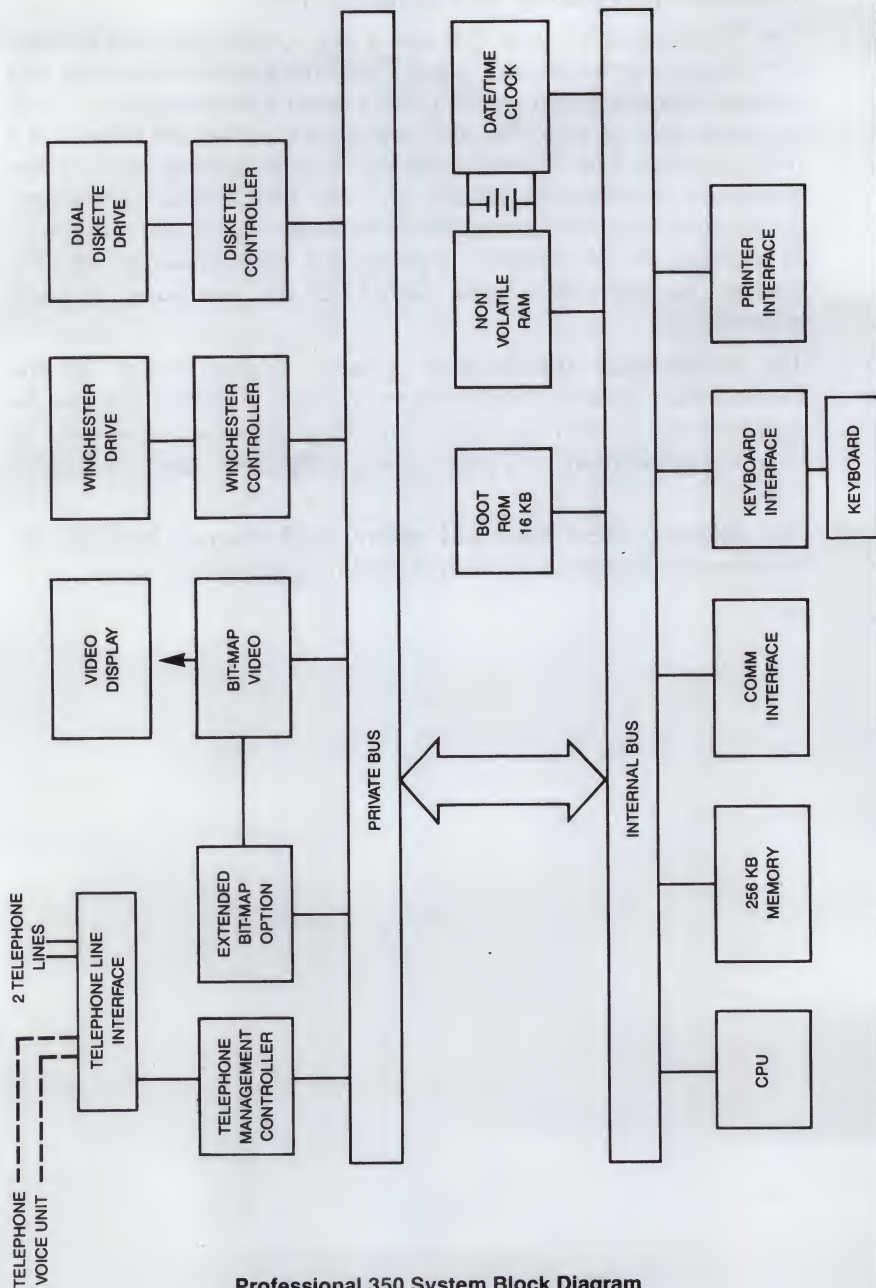
The Extended Bit-Map Option provides three planes of bit-mapped storage 960 horizontal by 240 vertical pixels. Each pixel is associated with three numbers stored in the bit map — representing one of eight unique values. The colour map translates these values into a specific colour — a combination of red, green, and blue. There are four blues, eight reds, and eight greens, which can be combined into 256 different colours — that is, $8 \times 8 \times 4 = 256$. The colour of each pixel can be individually controlled.

Professional Quality and Performance

The Professional 325 and 350 add a new quality and performance dimension to personal computing. They offer powerful hardware and software features found on DIGITAL's larger minicomputers — with the same level of reliability and consistency you would expect of a minicomputer. The Professionals also feature options such as the telephone management system and the Professional Developer's Toolkit that bring new capabilities to the realm of personal computers. In addition, the Professionals' sophisticated communications and file transfer facilities are ideally suited to the computer network environment.

The Professionals' menu-driven software is easy to use. Yet the Professionals' powerful, multi-tasking operating system can handle sophisticated computing tasks involving personal, business, or technical applications at a price substantially lower than comparable systems.

The following Micro Spec and system block diagram highlight the Professionals' features and internal system organization.



Professional 350 System Block Diagram



Professional 325 and 350 System Summary

Standard System:	System unit, keyboard, display screen, and operating system
System Unit:	Small box (Professional 325) Large box (Professional 350)
CPU	F11 (PDP-11/23) microprocessor
Memory	256 Kbytes
Printer Port	Serial, RS232
Communications Port	Asynch/synch, up to 9,600 baud with modem control
Storage	Dual diskette drive (2 x 400 Kbytes)
Video Output:	Monochrome, RS170 Compatible
Operating System:	Professional Operating System (P/OS), multi-tasking software
System Expansion:	1 option slot (Professional 325) 4 option slots (Professional 350) User-installable

Hardware Options:

- Integral 5 Mbyte Winchester disk drive (Professional 350 only)
- Floating point adapter (does not require an option slot)
- Extended bit-map graphics option
- Telephone management system (Professional 350 only) with dual-port modem/capability
- Voice unit for telephone management system
- Choice of LA50 Personal Printer, Letterprinter 100, or LQP02 Letter-Quality Printer
- System unit stand for vertical floor mounting.



Chapter 6 Services and Support

DIGITAL's Personal Computers Service and Support

One of the most important benefits you get from owning a DIGITAL personal computer is DIGITAL's support service. Your personal computer is an important investment, and DIGITAL is dedicated to helping support your investment for as long as you own your system. We complement our new personal computers with the most advanced and flexible service offerings in the industry.

DIGITAL offers a variety of services to meet your individual needs and help you successfully use your new DIGITAL personal computer and its associated products. These include hardware services, educational programs, software services, application support packages and new, cost-effective support agreements for on-site support.

DIGITAL brings to the services market place a quarter of a century of computer experience. Our Customer Services organisation is backed up by a one billion dollar spare parts inventory, extensive computer networks and dedicated support staff totalling 16,000 professionals operating at 400 service locations worldwide.

Professional Support Offerings Help You Get Started

To help you choose the right DIGITAL personal computer for your needs, we offer Decision Support Services. This is a consulting service that can take place before you actually purchase any of our personal computers to help you define the kind of personal computer that will be most useful and cost-effective for your application and provide you with an understanding of the capabilities of our personal computers. Whether you are planning for a large corporation, a small business, or as an independent professional, this consulting service can be very beneficial.

Decision Support can entail a feasibility study to determine how one of our personal computers and its applications could be best used in your business environment or shop floor. We can also develop a detailed

evaluation geared towards solving business problems. From this evaluation, we can recommend the best solution.

Installation Support

DIGITAL also provides the help you need to install your new personal computer.

Our personal computers — the Rainbow 100, DECmate II and the Professional 325 or 350 — are designed to be user-installed and come equipped with a customer installation guide with step-by-step instructions and a central telephone help line to call to resolve installation questions. Should you require it, however, we can also have one of our trained engineers install the system for you. If you should require additional help, DIGITAL offers a start-up service that is designed to help expedite your learning process. We will help you install your application, set up computer files and programs and assist you with loading data — whatever it takes to help you use your new system successfully.

Training at your Fingertips

DIGITAL offers a friendly, "Do Me First" Computer-Based Instruction (CBI) course, which is available with all of our personal computers and is a standard feature on the Professionals. This specialized training course helps you learn, use and quickly become productive on your new system. The integral CBI uses computer exercises and special graphics to guide you through the basic features of your personal computer. As you interact with the computer, you learn how your system works as it demonstrates the many functions it will perform.

Diagnostics Isolate Problems

Computer users can help to do their own first-line maintenance.

A special set of diagnostics has been built into your system. It checks to see that the system is functioning properly and helps you locate the source of any problem in your system by showing diagnostic messages on the screen. DIGITAL's Professional personal computer even shows a picture of the personal computer on the screen and indicates the location of the problem visually as well as with text. Because the fault

can be simple, you can often correct the problem yourself. More complex problems, although rare, may require additional help from DIGITAL.

12 Months Warranty

Each DIGITAL personal computer comes with a full year of hardware warranty covering labour and materials. During the first year any services required under this warranty will be delivered free of charge on your premises. If your equipment requires on-site hardware service, a local support specialist will be dispatched to your site within 24 hours to provide assistance. Fully trained by Digital and familiar with all aspects of your personal computer, these specialists will provide the assistance you need to get your system completely operational again. A special fleet of maintenance vans, equipped with repair facilities, replacement parts and test equipment ensure an efficient service.

In addition a central telephone help line has been provided to ensure fast and effective response to questions concerning your new systems installation, warranty, hardware, software, training or accessories and supplies. By calling this service centre you can get answers to any questions you might have concerning the use, operation or maintenance of your personal computer and associated equipment. DIGITAL specialists will help you or assign your questions to the appropriate hardware or software specialist who can act on your problem right away.

System Support Agreement

To help keep your system operating at peak efficiency, DIGITAL offers a System Support Agreement. This total service package provides fast-response services covering both DIGITAL's hardware and operating system software.

The availability of your computer system can be critical to your business and our service representatives make every effort to perform remedial maintenance quickly and efficiently. A major feature of the System Support Agreement is a guaranteed 4 hours response to your call for assistance. Your service representative has access 24 hours a day, seven days a week, to an inventory of all parts and materials stocked at DIGITAL's local branch and Regional Distribution Centres. In addition, DIGITAL's automatic inventory management system ensures continuous local stocking of all spare parts.

Also included in your System Support Agreement are the following benefits:

Engineering Modification — Your System Support Agreement helps ensure that your DIGITAL personal computer will continue to reflect “state of the art” computer technology after you have purchased it. The System Support Agreement includes updating your equipment to keep it compatible with any future hardware and software offerings. As new technological developments are made, any applicable hardware updates or enhancements will be installed at your site.

Software and Documentation Updates — DIGITAL will make available new DIGITAL system software updates or documentation updates. These updates are designed to help improve your system’s operation and thus your productivity.

Applications Support Agreement

Personal computing is really all about “applications” and DIGITAL has the applications software and supporting services you need.

DIGITAL’s Classified Software catalogue carries a growing number of applications software products that DIGITAL can make available to you, the user. These application software products cover every conceivable application from Finance to Manufacturing, from Laboratory analysis to Portfolio management. Many DIGITAL Classified Software products will be fully supported by DIGITAL’s specialists and program updates for such products will be made available to help to keep your applications trouble free and up to date. Through an Applications Support Agreement you will have access to a Comprehensive Applications Support Service network. This provides you with a fast-response application service that has access to large databases of information regarding application products, known problems and fixes and a mechanism for registering queries and suggestions regarding your own applications. In short, a complete service designed to maximise your application’s effectiveness and thus assist you in meeting your business objectives.

On-Site Consulting

Even though the DIGITAL’s Classified Software catalogue will carry hundreds of ready made applications software products, we know

that you may have an application that requires a more tailor-made approach. Over the years we have been involved with every conceivable type of applications software development project. Projects catering for air traffic control to food processing, from large banking systems to integrated office automation systems, from financial modelling systems to inventory control — we have seen them all. Our specialists are highly trained in sophisticated project management techniques and can draw upon thousands of specialised resources for analysis, design, development and implementation of your special application. In this way your project is brought to a successful completion on-time, on budget, using only those resources needed at any point in time and for only as long as they are needed.



Customer Education

DIGITAL offers one of the largest, most diversified computer education programs available in the industry. The courses on general computer subjects and hardware/software training range from the very basic to the most advanced, to give you complete system support. Our educational resources include 26 facilities worldwide with more than 500 computer systems for direct, personalised, hands-on training.

We offer courses in either lecture/lab or self-paced instruction formats. These include the use of printed subject matter, audiovisual materials, and Computer-Based Instruction. The courses are designed to help you apply your personal computer to different tasks and help you gain confidence in its use and capabilities.

Your first introduction to DIGITAL's customer education programs might be with your personal computer's Computer-Based Instruction, a very effective learning tool. More advanced courses are also available.

We also provide a special Repair Guide designed for customers who own one of our Professional personal computers. The Repair Guide will help you provide your own first-line maintenance on your system. This guide, augmented by useful pictures and diagrams, leads you in a simple step-by-step manner towards understanding problems down to the replaceable part level. This helps both you and the service technicians fix problems in the shortest possible time.

A "How to Program in BASIC" course is also available. This Computer-Based Instruction course teaches you how to program your personal computer, right on the computer. You will learn the fundamentals of the BASIC language and, in a very short time, you can be developing, writing and running your own programs.

For business professionals, a series of practical courses provide needed information. The DIGITAL Professional Computer Education Series are selfpaced, audiovisual courses designed to help you make decisions related to computer applications and computer programs. The series moves through three specific levels of learning, providing:

- An overview that explains what computers can do for your business or organization.
- A more detailed approach goes from concepts to an actual "how to" approach to Database Management System (DBMS), data communications, and software development.

- An advanced approach for those who understand computers and who are ready to design a system or network.

In addition to the Professional Computer Education Series, DIGITAL has developed the Personal Computer Seminar Series that focuses on the needs of personal computer users. Taught by experienced experts in the personal computing field, the first seminar discusses the capabilities and applications of personal computing and looks towards some of the trends for the future. Other seminars cover BASIC programming and the development of "personal" applications, including modelling, graphics, maths, statistics and the role of personal computers in large system environments.

Accessories and Supplies

DIGITAL has more than 3,000 off-the-shelf products available worldwide to further support your new personal computer system. These support products include a wide range of operating supplies, maintenance, and system enhancement products. There are also customer spares, accessories, documentation, and literature. They can all be ordered from your local DIGITAL Sales Office.

A complete range of complementary workstations, filing systems, printer stands and copy holders, designed to reduce operator fatigue and complement your work place, will soon be available.

Self-Maintenance— Customer Spares provides individual components, minor and major assemblies, cables, and a variety of economical spare kits. Our self-maintenance support includes a free Maintenance Products Recommendation Service (MPRS) and related handbooks for customers to help simplify the inventory planning requirements of a self-maintenance program.

Software Documentation— Computer Supplies offers a complete line of software documentation for DIGITAL personal computer customers.



Chapter 7

Digital Equipment Corporation

The History of Personal Computing

DIGITAL made quite a sensation in 1960 by announcing the first "personal" computer, the PDP-1. The PDP-1 was small by standards of the day but it was a fast, powerful computer designed to give instant results. It didn't store the same amount of information as the multimillion-dollar computers of the late 50s but its computing power was exceptionally good. It was unique in one respect — price. At \$120,000, the PDP-1 put computing power within the reach of many more people.

The PDP-1 was different in another even more important way. Users could change its programming midstream and "talk" to it through a simple keyboard. It answered by displaying messages or data on a small video screen or by typing on a printer. The PDP-1 was the first commercial computer to offer this interactive capability. It was, indeed, a unique idea that led directly to today's personal computers.

DIGITAL Announces the First Production Minicomputer

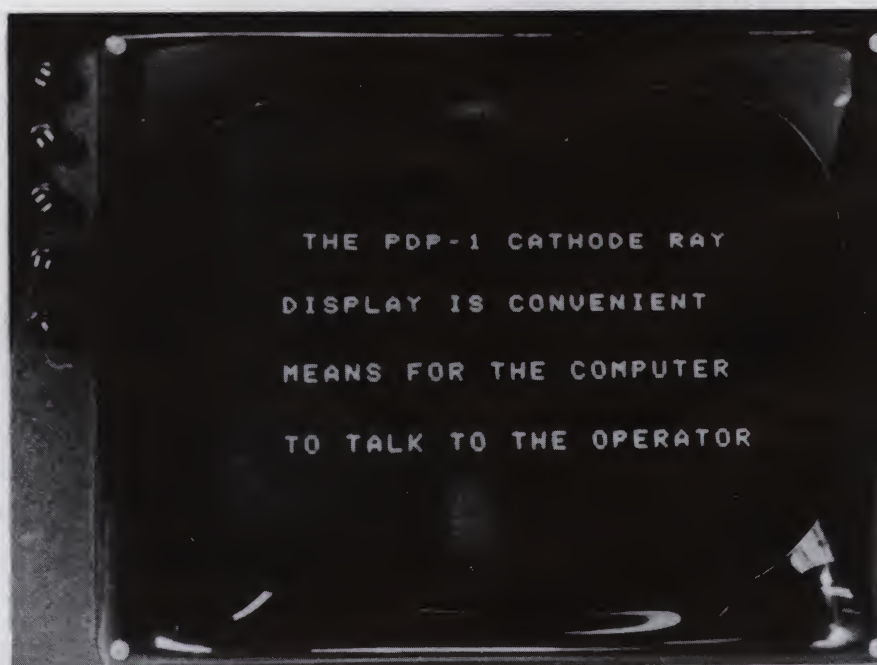
In 1965 DIGITAL introduced the first mass-produced minicomputer — the PDP-8. The PDP-8 started a revolution in interactive computing. It was small enough to sit on laboratory benches or desktops, wherever people worked, and it was accessible to anyone who cared to learn its relatively simple languages and routines. A PDP-8 could be purchased for just \$25,000, putting true data processing within the reach of modest business budgets for the first time. In fact, the PDP-8 was so well-designed that its basic architecture still performs at a level comparable to that of today's equipment. Using new integrated circuit technologies, the PDP-8 has been reduced in size and its performance is even better. The new PDP-8s provide reliable, very powerful, minicomputer intelligence for several of DIGITAL's current products.

Digital Equipment Corporation — Parker Street facility,
Maynard, Massachusetts.

The PDP-8s went everywhere. By 1966 DIGITAL had designed a PDP-8 that could be purchased for under \$10,000. In 1968, a time-shared PDP-8 was introduced; thirty-two people could sit at different terminals and use it simultaneously. The resources of the computer were shared in such a way that each person felt as though he were using his own personal computer. Behind this independence lay another DIGITAL concept that was to influence the future of computers: install computing capability where it's needed and where it's easily accessible to those who use it. Today, this concept is known as distributed data processing.

DIGITAL Begins a "Family" Tradition

In 1970 DIGITAL introduced a new computer architecture, the PDP-11. This minicomputer continued the tradition established by the PDP-8 of giving very high-level computer performance at a very low price. In fact, the PDP-11 was based on a newer technology that would allow the performance of minicomputers to be pushed upward to nearly match the performance of the large expensive mainframe computers.



The PDP-11 offered DIGITAL's customers something entirely new in the computer industry—easy expandability. DIGITAL's new electrical interconnection path, UNIBUS, lets customers add more options to their computer system without having to change the components they had already purchased.

DIGITAL had introduced the concept of a "family" of compatible computers. Now businesses could easily expand the capabilities of their current PDP-11 or dramatically increase their computing resources by purchasing a much larger PDP-11 minicomputer. They wouldn't have to forfeit the investment they had made in the original equipment. In most cases, the older equipment could be integrated into the new system.

In the rapidly changing world of computer technology, DIGITAL had introduced some stability. The PDP-11 family of minicomputers eliminated the fear of obsolescence that made many businesses shun the use of computers. Within any "family" of DIGITAL computers, you know that tomorrow's technology will be able to work with the computer you purchase today.



DIGITAL Brings Computer Power to the Office

In 1972 DIGITAL introduced the DEC Datasystems for commercial applications. Based on a powerful DIGITAL minicomputer, the DEC Datasystems featured software that was "friendly" enough to let regular office workers use the power of the computer like experts. A large number of terminals could be placed in the office on the desks of the people who needed them. In many ways this sort of system with its "user-friendly" software was the predecessor of today's professional personal computers.

In 1976 DIGITAL announced the WPS-8 Word Processing System, and in 1977, the DECstation. Both were small, inexpensive computers designed to be used by one person. They offered a professional word processing capability and the computing power of a small DIGITAL minicomputer. And all of this was combined with a menu approach to the computer that made using it even easier than before.

The Home/Hobby Computer Arrives

1977 was also the year that the most popular home/hobby computers arrived on the scene. These latest personal computers featured a very low price. They offered games and other software for home use but they were very limited in their computing ability. Their low price made personal computing more popular than it ever was before.

As people began to use home/hobby computers for productive work, they quickly discovered that they wanted more room to store information and more power to perform calculations. The manufacturers of these computers are now expanding their capabilities upward.

A New Generation of Personal Computers Begins

The tradition DIGITAL established for personal computing continues today. DIGITAL's personal computers take DIGITAL's 25 years of interactive personal computing experience one step further. These computers are even easier to use than before but they haven't sacrificed any of the power of DIGITAL's traditional minicomputers. They have been designed to do the work of a professional or a business person. They can handle the records and the calculations necessary to be useful and DIGITAL's personal computers have been packaged to fit conveniently on your desk.

Digital Equipment Corporation

At DIGITAL, our goal has always been to provide easy-to-use computers that help people get their jobs done more efficiently. Because our computer products have met that goal, DIGITAL has grown into a Fortune 200 company with more than 63,000 employees and total operating revenue exceeding \$3.2 billion. Presently, DIGITAL supplies computer equipment throughout the world through 485 sales and service offices.

We manufacture all of our own computer equipment at 28 major manufacturing sites around the world. Our total manufacturing spaces — eight million square feet — is the second largest in the computer industry. Our products range from microcomputers costing only a few hundred dollars to large, powerful, timesharing computer systems costing one million dollars or more. We design and develop all of our products on the basis of our experience and dedication to quality and reliability.

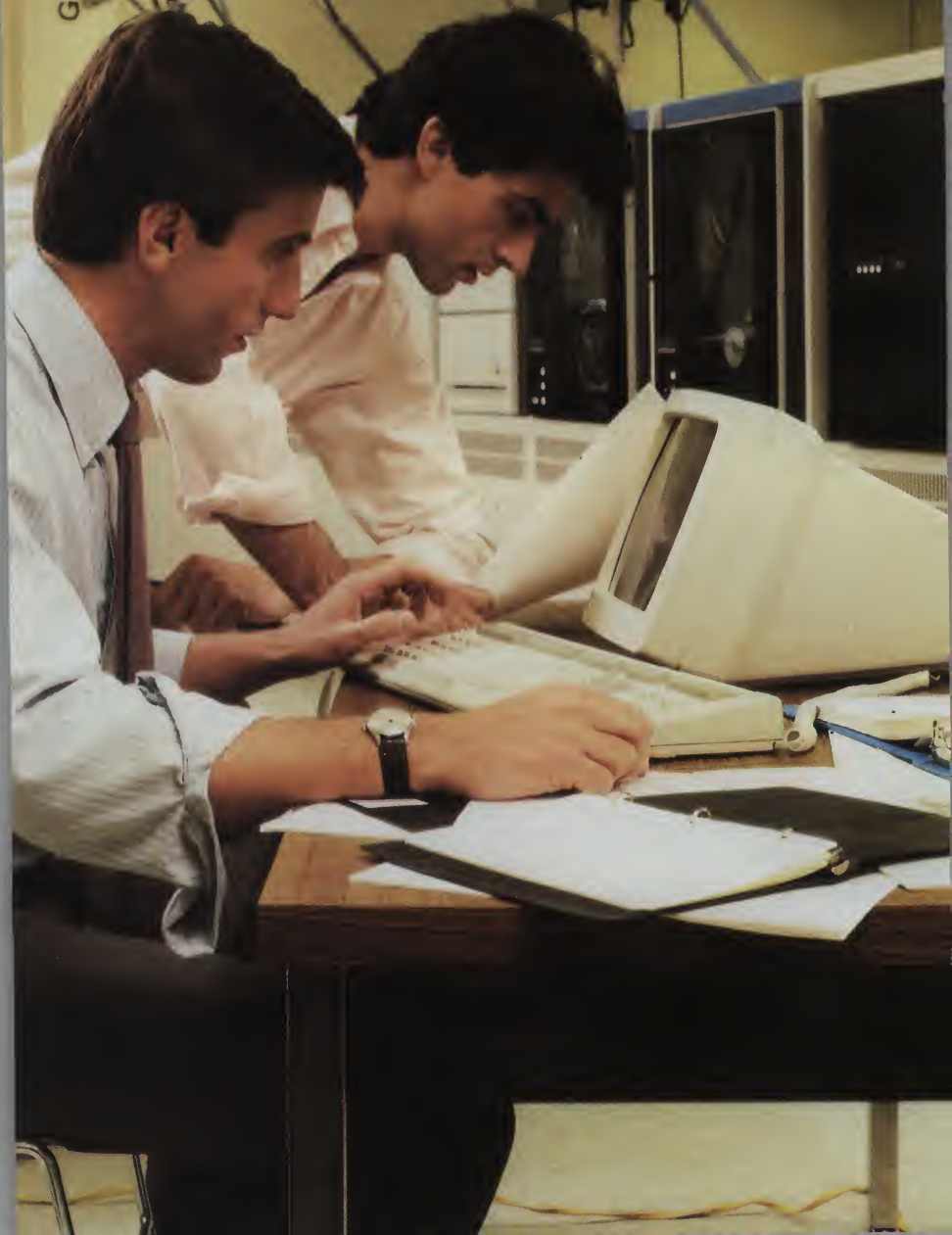
DIGITAL has installed more than 305,000 computers and offers a broad range of computer products and services. DIGITAL is the world's leading minicomputer manufacturer and is also a leader in total installations of mainframes, minicomputers, and microcomputers.

DIGITAL has always tried to meet the changing needs of our customers. To do this we have maintained a very high level of research and development. During Fiscal Year 1981, we spent more than \$250 million on new product research and development to ensure that our future products will be on the leading edge of technology. Another important standard that DIGITAL has maintained is compatibility. We are dedicated to keeping our product features consistent, to ensure that your investments are protected. This makes growth and migration easier for your equipment and software.

All of DIGITAL's products are backed by a total support team. More than 16,000 support personnel make up DIGITAL's Educational Services, Field Services, Software Services, and Computer Special Systems groups. Our training curriculum includes more than 300 courses offered in 17 languages. In addition, we offer self-paced computer courses, interactive computer-based instruction, and classes at customer sites. And there are 26 DIGITAL training centres located in or near major cities.

DIGITAL also has its own computer users society — called DECUS. DECUS is one of the largest and most active computer users' groups in the world. Through DECUS you will be able to meet many other DIGITAL equipment users and exchange ideas and information. DECUS sponsors local, regional, national and international meetings and symposia for its members. It also maintains a library of more than 1,500 software packages written and submitted by DECUS members for the use of others.

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Appendix

The Professional Toolkit:

A Software Application Development Environment

The Professional Toolkit is designed for organisations that wish to create software products for the Professional 350 and 325 personal computers. This software can be for their own use or to market as finished products. The Toolkit provides a total software development environment that lets you make the most of the Professional's hardware and system software features. The environment supports those features with the utilities and processing power of DIGITAL's well-established PDP-11 and VAX minicomputers, and well-known DIGITAL software including the VMS and RSX-11M/M-PLUS operating systems, BASIC-PLUS-2, RMS record and file management, and FMS forms management.

The Toolkit was conceived by DIGITAL to satisfy the needs of the personal computer end user *and* the applications developer. For the end user of the Professional 325 or 350, the Toolkit makes possible applications products that present the same simple, consistent user interface as the Professional's system software — regardless of where the application was developed and purchased. You'll be able to install and run uniform applications that take advantage of your personal computer's friendly software environment.

For the applications developer, the Toolkit contains the tools, documentation and guidelines that will let you gracefully integrate your applications into the Professionals' software environment. You can thus take full advantage of the friendliness of the Professionals' user interface and the power of their operating system.

DIGITAL is the first computer manufacturer that offers you such a complete software development package for personal computers. Among the many benefits of the Toolkit approach are:

- Uniform applications products for the end user from several sources — your applications can be fully integrated into the Professionals' system software.

- Proven DIGITAL hardware and software — helps to reduce ownership, development, and training costs.
- Maximises programmer productivity — use of standard DIGITAL software reduces time needed to market/install applications.
- Preserves your current hardware and software investment — applications are developed on existing host systems for use on the Professional 325 and 350.
- Utilises full PDP-11 instruction set - PDP-11 microprocessor inside the Professionals uses same instruction set found on DIGITAL's larger computers.
- Provides you with software consulting services and training — helps you to develop applications for DIGITAL's new generation personal computer software.
- Allows for future Toolkit expansion — additional languages and development aides can be added in the future to make it even easier to write Professional-based applications.
- Enables you to use *any* computer system that runs DIGITAL's RSX-11M, RSX-11M-PLUS or VAX/VMS software — from PDP-11/23 to VAX 11/780 systems.
- Lowers development costs — you benefit from the efficiency of minimum programmer retraining.

Program developers and data processing managers realise that their total system cost consists of the hardware purchase, software development, staffing, and training costs. Sometimes, the actual system purchase can obscure long term software development, staffing, and training costs. Over a period of time, however, the size of your personnel costs and software investment is considerable.

The Toolkit helps you control software development costs. Whether you're a programmer for a software vendor or data processing department, the Toolkit can reduce the time — and cost — you need to get your personal/professional applications to the end user. Many RSX-11M and VMS systems have been installed by DIGITAL. Chances are your programmers have used these systems or are familiar with their operation. By using the host system's resources, the Toolkit can help you maximise programmer productivity and reduce the need for retraining or for hiring additional staff.

Toolkit Components

The Toolkit's development environment spans two computer systems — a host computer and a programmer's personal computer. The host can be a DIGITAL RSX-11M, RSX-11M-PLUS or a VAX/VMS system. The programmer's personal computer is a Professional 350 with the Winchester disk option. Software for the Professional and for the host system completes the development environment. You will also need the hardware to connect the host to the Professional 350.

The software components that reside on the Professional 350 personal computer include an Application Diskette Builder and an Interactive Debugger for Professional development languages.

The Professional Toolkit is a software development package. The hardware, programming languages, and communications software must be purchased separately.

The software components that reside on the host system include:

Professional Development Languages— Specialised versions of DIGITAL's popular high-performance programming languages have been expanded to support the special features of the Professionals. These features are accessible by CALL statements to the appropriate library routines. Currently available are BASIC-PLUS-2 Version 2.0, FORTRAN 77 and DIBOL. Other languages are being prepared for release.

Frame Builder— This is the library of routines for driving all the special hardware and software features of the Professional 350 and Professional 325, such as the keyboard and display screen, the end-user menus, help messages, and other user-interface features.

RMS/Professional— RMS/Professional is a powerful set of service routines that provide efficient and flexible data storage, retrieval and modification. These service routines provide an interface between the Professional Operating System and application programs. User programs interface to RMS/Professional through statements or function calls that provide logical record I/O to data files. RMS/Professional provides the kind of data management services you need to create sophisticated data-processing applications — such as multi-key access to index sequential (ISAM) files. Since it is widely used on other DIGITAL computers (including RSX and VAX/VMS

systems), you can create applications for the Professional that can easily exchange data with larger systems.

Professional Graphics Package— This is a library of device-independent low-level graphics and graphing functions, based on the well-known SIGGRAPH CORE graphics guidelines. Among the many library functions are routines that:

- draw lines, polygons, curves, circles and text on the Professional display screen;
- set attributes of the display such as colour and line style (dotted, dashed, and so on);
- label picture parts so that these parts can be moved, replicated or deleted by name;
- partition the display into windows and viewports, and control what these partitioned areas contain.

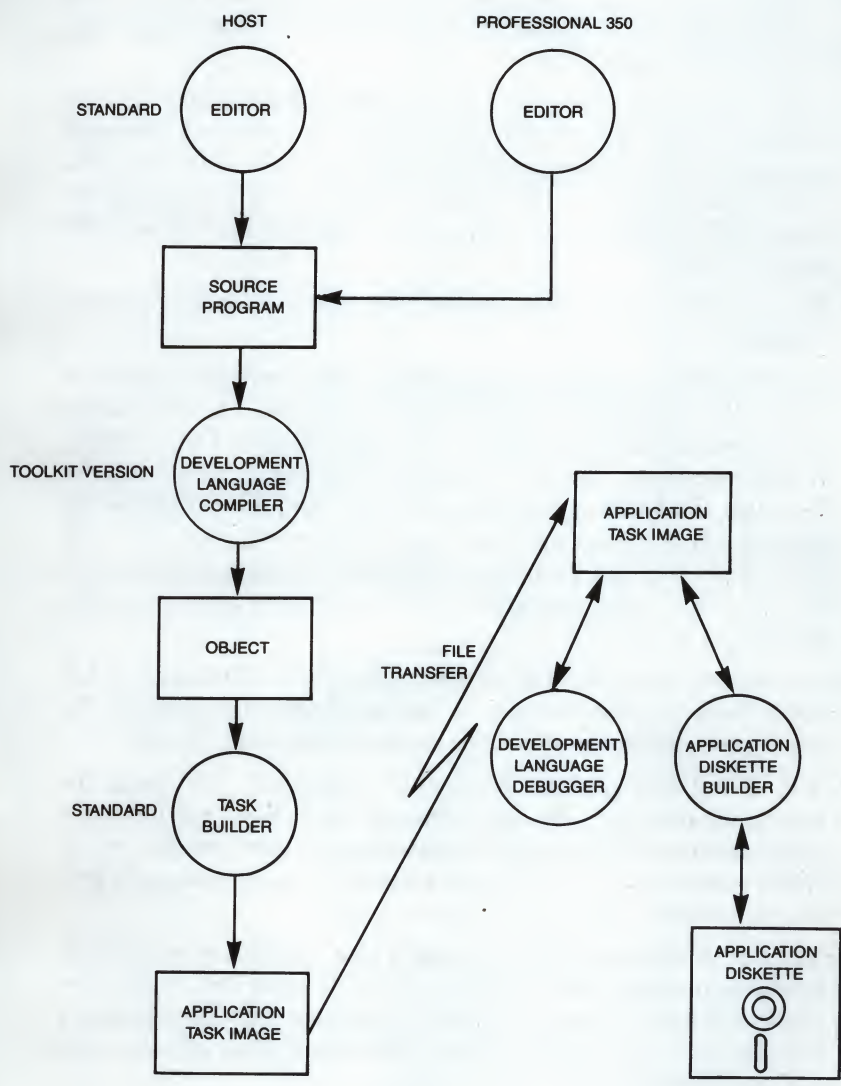
These routines are callable from the Toolkit's development languages, and allow developers to build detailed control of picture-generating process into their software.

FMS/Professional— FMS/Professional is a powerful forms management tool that lets you build "fill-in-the-blanks" data entry into your application. It is also widely used on DIGITAL systems, and uses RMS/Professional for handling the data it takes in, giving you even more flexibility and opportunities for compatibility with larger systems. It is designed for use as an independent front-end that logically offloads the complexities of video I/O management from the application program.

Sort/Professional— This is an efficient, all-purpose sorting utility that you can incorporate in your application wherever you need it. The possible sorting processes are record sort, tag sort, address routing sort, and index sort.

Host File Transfer— This utility enables the transfer of files between the host development system and the Professional.

Toolkit Documentation— The Toolkit comes with extensive documentation on how to conform to the Professional's software performance and user interface so you can customise your software to make it look like a natural extension of the system. The documentation includes a directory to all the documents contained in the kit. In addition, manuals describe how to design and document applications.



PROGRAM DEVELOPMENT CYCLE

Using the Software Development Toolkit

You can perform all phases of software development seated at the Professional 350, using it alternately in local mode and in terminal emulation mode in communications with the host system. In general, you would follow these steps:

- Enter and edit the program's source code using the host system's standard editor. It is also possible for you to enter and edit your program on the Professional 350 system in local mode, using the Professional editor. You would then send the file containing the source code to the host for compilation, using the Professional's file transfer utility.
- You compile the program on the host using a Toolkit language compiler.
- You build the application program task image using the RSX-11M task builder on either the RSX or VMS host system. The task builder can reference the development languages Object Time System, RMS/Professional Library, Professional System Software Service Routines, Professional Graphics Package, and FMS/Professional Library. Only those routines and libraries required for your application and target hardware configuration are included in the resulting task image, giving you a great amount of control over the size of your application.
- You transmit the task image from the host to the Professional 350 using the file transfer utilities. At the completion of the transfer, the application task image will reside on the Professional 350 disk.
- You debug the application on the Professional 350 using the interactive debugger. By incorporating the Professional hardware and software options of your intended target system into the one on which you are performing your debugging, you can see exactly how your application will run as a finished package.
- When you have successfully debugged your application, you put the application onto a diskette for distribution using the Application Diskette Builder program on the Professional 350. The result is a diskette ready to be installed by an end user on either a Professional 350 or Professional 325.

**Minimum Host
Hardware/Software Configurations
for the Professional Toolkit**

Micro Spec



RSX-11M and RSX-11M-PLUS Systems:

- PDP-11/23 Processor
- 256 KB Memory
- 2 RL02 Disks, 20 MB total
- Hardcopy Terminal
- 9600 baud Async serial line to Professional 350
- RSX-11M Version 4 or RSX-11M-PLUS Version 2 Operating System

VAX System:

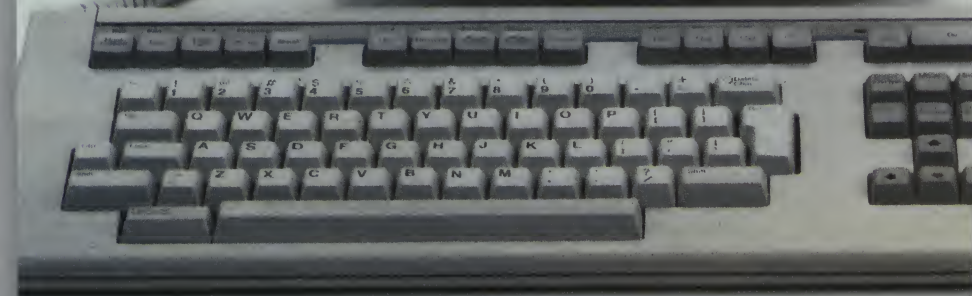
- VAX-11/750 Processor
- 1 MB Memory
- 2 RK07 Disks, 67 MB total
- Hardcopy Terminal
- 9600 baud Async serial line to Professional 350
- VAX/VMS Version 3 Operating System

Professional Realtime Interface Module

The Professional Realtime Interface Module combines three realtime input/output functions onto a single interface module. The interface includes:

- An IEEE-488 (1978) General Purpose Instrument Bus that allows the Professional to act as a master or a slave and to control up to 15 compatible devices.
- A two-line EIA RS423-compatible serial asynchronous port with user-selectable baud rates (50 to 9600 baud) and serial word format (data word length, number of stop bits, parity), a full modem control.
- A 24-line parallel port with 16 data lines and 8 control lines for connecting the Professional to TTL or DTL external devices.

The interface module provides customers with several significant benefits. The serial and IEEE interfaces allow Professional systems to control and acquire data from any external devices conforming to the appropriate industry standards, including most analytical instruments and automatic test equipment. The parallel interface enables customers to acquire Binary Coded Decimal inputs. It also allows Professional systems to be used in custom-designed, interrupt-driven input/output applications. All three interfaces can be used with compatible third-party products to provide analog input/output. These capabilities, combined with the Professional's standard features, help it satisfy the business and scientific requirements of the technical professional.



Glossary

Access time: The time required to obtain data from main memory or a storage device, such as a diskette or a Winchester disk.

Acoustic coupler: A device for transmitting data over phone lines by converting electrical signals into audio signals, and vice versa. See data communications and modem.

Applications: A specific program or task, such as sorting employee records, to which a computer solution can be applied.

Application program: A computer program designed to meet specific user needs such as a program that controls inventory or monitors a manufacturing process.

Architecture: In the case of computers, architecture often refers to the design or organisation of the Central processing unit (CPU).

ASCII: (The American Standard Code for Information Interchange.) Code that has assigned a binary number to each alphanumeric character and several non-printing characters used to control printers and communication devices. The binary number (code) assigned to each alphanumeric character is called ASCII code.

ASCII keyboard: A keyboard that sends an ASCII character to a computer when a typist presses the corresponding key.

Asynchronous: A communications method in which data is sent as soon as it is ready, as opposed to methods in which data is sent at fixed intervals.

Background: Refers to one or more noninteractive services running on a personal computer while the user is using another interactive (foreground) service.

Background processing: The automatic execution of a low-priority computer program when higher priority programs are not using the system's resources. See foreground processing.

Backup: Copying of one or more files onto a storage medium for safekeeping, should the original get damaged or lost.

BASIC: (Beginners' All-purpose Symbolic Instruction Code) a widely used interactive programming language developed by Dartmouth College that is especially well-suited to personal computers and beginning users.

Batch processing: The technique of executing a set of computer programs without human interaction or direction during their execution. Under certain conditions, direct interaction is possible.

Baud: A unit of data transmitting/receiving speed, roughly equal to a single bit per second. Common Baud rates are 110, 300, 1,200, 2,400, 4,800, and 9,600.

Bidirectional: (1) Ability to transfer data in either direction, especially on a bus. (2) Ability of a print head to print from right to left and from left to right, which helps increase print speeds.

Binary: (1) Number system with only two digits — 0 and 1 — in which each symbol represents a decimal power of two. (2) Any system that has only two possible states or levels, such as a switch that is either on or off. This is represented in a computer circuit by the presence of current (equivalent to "1") or its absence (equivalent to "0"). All computer programs are executed in binary form.

Bit: Short for binary digit, which can have only two possible values — 0 or 1. It is the smallest unit of data recognised by the computer. All data (letters, numerals, symbols) handled by a computer are digitised, i.e., expressed entirely as a combination of bits — 0s and 1s.

Bit-map graphics: A technology that allows control of individual pixels on a display screen to produce graphic elements of superior resolution, permitting accurate reproduction of arcs, circles, sine waves, or other curved images that block-addressing technology cannot accurately display.

Board: Also circuit board. A plastic resin board containing electronic components such as chips and the electronic circuits needed to connect them. See option module.

Buffer: A temporary storage area for data, frequently used to hold data being passed between computers or other devices, such as printers, which operate at different speeds or different times.

Bus: A group of parallel electrical connections that carry signals between computer components or devices.

Byte: The number of bits used to represent a character. For personal computers, a byte is usually eight bits.

Cathode-ray tube (CRT): A vacuum tube that generates and guides electrons onto a fluorescent screen to produce such images as characters or graphic displays on video display screens.

Central processing unit (CPU): Electronic components in a computer that control the transfer of data and perform arithmetic and logic calculations.

Character: A single printable letter (A-Z), numeral (0-9), or symbol (, % \$.) used to represent data. Text symbols also include those that are not visible as characters, such as a space, tab, or carriage return.

Character code: A code that assigns numerical values to characters, such as ASCII code.

Character printer: A printer that prints one character at a time like a typewriter. See lineprinter.

Chip: A piece of semiconductor material containing microscopic integrated circuits.

Circuit: (1) A system of semiconductors and related electrical elements through which electrical current flows. (2) In data communications, the electrical path providing one-way or two-way communication between two points.

COBOL: (Common Business-Oriented Language) A high-level programming language that is well-suited to business applications involving complex data records (such as personnel files or customer accounts) and large amounts of printed output.

Command: A user instruction to the computer, generally given through a keyboard, which can be a word, mnemonic, or character that causes a computer to perform a predefined operation.

Compatibility: (1) The ability of an instruction, program, or component to be used on more than one computer. (2) The ability of computers to work with other computers that are not necessarily similar in design or capabilities.

Computer network: An interconnection of computer systems, terminals, and communications facilities.

Configuration: The assortment of equipment (disks, diskettes, terminals, printers, etc.) in a particular system.

Core: The older type of non-volatile computer memory made of ferrite rings that represents binary data by switching the direction of polarity of magnetic cores. Most modern computers use integrated circuits, which are faster than core memory, but volatile.

CP/M (Control Program for Microprocessors): An operating system used by many personal computers.

CPU: See central processing unit.

CRT: See cathode-ray tube.

Cursor: A movable, blinking marker — usually a box or a line — on the terminal video screen that defines the next point of character entry or change.

Daisywheel: A print head that forms full characters rather than characters formed of dots. It is shaped like a wheel with many spokes, with a letter, numeral, or symbol at the end of each spoke. The print method used is similar to that of a regular typewriter. See dot-matrix printer.

Data: Facts, numbers, letters and symbols stored in the computer. For personal computer users, data can be thought of as the basic elements of information used, created or otherwise processed by an application program. Examples of data are the employee names, weekly deductions from salary, projected sales and fuel consumption.

Database: A large collection of organised data that is required to perform a task. Typical examples are personnel files or stock quotations.

Data communication: The movement of coded data from a sender to a receiver by means of electrically transmitted signals.

Data diskette: A diskette that is used entirely or primarily to contain data files.

Data processing: The application in which a computer works primarily with numerical data, as opposed to text. Many computers can perform data processing and word processing.

DECUS: (Digital Equipment Computer Users Society) The largest and most active computer users group in the world. Through DECUS, DIGITAL personal computer owners can meet other DIGITAL equipment users and exchange ideas and information. DECUS sponsors local, regional, national and international meetings and symposia for its members and maintains a library of more than 1,500 software packages written and submitted by DECUS members for use of others.

Dedicated computer: A computer built for one special function such as controlling the Space Shuttle's navigation system.

Device: In computers, a piece of hardware that performs some specific function. Input devices (e.g., keyboard) are used to get data into the CPU. Output devices (e.g., printer or display monitor) are used to take data out of a computer in some usable form. Input/output devices (e.g., terminal or disk drive) are able to perform both input and output of data.

Diagnostic: A program that checks the operation of a device, board or other component for malfunctions and errors and reports its findings.

Direct memory access (DMA): A method for transferring data to or from a computer's memory without CPU intervention.

Disk: A rigid, flat, circular plate with a magnetic coating for storing data. Physical size and storage capacity of disks can vary.

Disk/diskette drive: A unit used to read data from or write data onto one or more diskette. DIGITAL's personal computers provide a dual diskette drive capable of holding two diskettes.

Diskette: A flexible, flat, circular plate permanently housed in a black paper envelope with magnetic coating that stores data and software. Standard sizes are 5¼-inches (used by DIGITAL's personal computers) and eight inches in diameter.

Display screen: A device that provides a visual representation of data; a TV-like screen. See cathode-ray tube.

Distributed data processing: A computing approach in which an organisation uses computers in more than one location, rather than one large computer in a single location.

DMA: See Direct memory access.

Dot-matrix printer: A printer that forms characters from a two-dimensional array of dots. More dots in a given space produce characters that are more legible. See also daisywheel.

Double density: Special recording method for diskettes that allows them to store twice as much data as in normal, or single-density, recordings.

Downtime: The period of time when a device is not working.

Draft-quality printer: A printer, usually high-speed, that produces characters that are very readable, but of less than typewriter quality. Typically used for

internal documents for which type quality is not a major factor. See letter-quality printer.

Drive: A peripheral device that holds a disk or diskette so that the computer can read data from and write data onto them.

Electronic file cabinet: A storage unit that stores data much like a regular file cabinet with some distinct advantages: a great deal of information can be stored in a small area, accessed and changed quickly, organised more efficiently, and stored more securely.

Electronic Industries Association (EIA): A standards organisation specialising in the electrical and functional characteristics of interface equipment.

Electronic mail: A feature that allows short memos or messages to be sent to another computer.

Emulator: A program that allows a computer to imitate a different system, thus enabling different systems to use the same data and programs to achieve the same results; but with possibly different performance rates.

Ergonomics: The science of human engineering which combines the study of human-body mechanics and physical limitations with industrial psychology.

Error message: In DIGITAL's personal computers, text displayed by the computer when an incorrect response is typed, which explains the problem and indicates what to do next.

Fanfold paper: A continuous sheet of paper whose pages are folded accordion-style and separated by perforations. Lengthy documents can be printed on it without having to manually insert individual pages.

File: A collection of logically related records or data treated as a single item. A file is the means by which data is stored on a disk or diskette so it can be used at a later date.

Filename: The sequence of alphanumeric characters assigned by a user to identify a file which can be read by both the computer and the user. On DIGITAL's personal computers, a file name has a maximum length of nine alphanumeric characters.

Flexible disk: See diskette.

Floppy disk: See diskette.

Font: A complete set of letters, numerals, and symbols of the same type style of a given typeface. Examples of typefaces are Baskerville, Century, and Helvetica. Examples of fonts are Baskerville Italic, Baskerville Bold, and Baskerville Bold Italic.

Foreground processing: Top-priority processing; it has priority over background (lower-priority) processing.

Formfeed: Automatically advances a roll of fanfold paper to the top of the next page or form when the printer has finished printing the previous form.

FORTTRAN: (Formula Translation) A widely used high-level programming language well-suited to problems that can be expressed in terms of algebraic formulas. It is generally used in scientific applications.

Function key: A key that causes a computer to perform a function (such as clearing the screen) or execute a program. On DIGITAL's personal computers, some function keys such as HELP, DO, and MAIN SCREEN and all the arrow keys have predefined actions.

Graphics: The use of lines and figures to display data, as opposed to the use of printed characters. See bit-map graphics.

Hardcopy: Output in a permanent form (usually on paper or paper tape) rather than in temporary form as on a CRT or visual display.

Hard disk: A disk that is not flexible, such as a Winchester disk. It is more expensive than a diskette but is capable of storing much more data. See disk and Winchester disk.

Hardware: The physical equipment that makes up a computer system.

Hardwired: Refers to a permanent, as opposed to a switched, physical connection between two points in an electrical circuit or between two devices linked by a communications line. When using a personal computer, local connections are typically hard-wired, whereas all connections through a modem are switched because they use telephone lines.

Head: A component that reads, writes or erases data on a storage medium such as a diskette or disk.

Help service: Messages displayed on the video screen that provide information on how to use applications and other system services.

Impact printer: A printer that forms characters on paper by striking an inked ribbon with a character-forming element.

IC: See integrated circuit.

Information services: Publicly accessible computer repositories for data, such as stock exchange prices or foreign currency exchange rates.

Instruction: A command that tells the computer what operation to perform next.

Integrated circuit (IC): A complete electrical circuit on a single chip.

Interactive: Capable of carrying on a dialogue through a keyboard with the user, rather than simply responding to commands.

Interface: An electronic assembly that connects an external device, such as a printer, to a computer.

Job: A task (program) for a computer to execute, such as reading a disk or printing a file.

K: The symbol for the quantity 2^{10} or 1024. The K is upper-case to distinguish it from lower-case k, which is a Standard International Unit for "kilo," or 1,000 (10^3).

Keyboard: The set of keys on a terminal that allows alphanumeric characters or symbols to be transmitted when keys are depressed. It inputs text and instructions to the computer.

Kbyte (KB): 1,024 bytes.

Large-scale integration (LSI): The combining of about 1,000 to 10,000

circuits on single chip. Typical examples of LSI circuits are memory chips, microprocessors, calculator chips and watch chips.

Letter-quality printer: The printer used to produce final copies of documents. It produces typing comparable in quality to that of a typewriter.

Lineprinter: A high-speed printer that prints an entire line of characters at a time.

List processing: The word processing application that permits many copies of a form document to be produced, with certain information changing from one copy to the next (e.g., the production of personalised form letters).

Local: Hardwired connection of a computer to another computer, terminal, or peripheral device such as in a local area network. See remote.

LSI: See large-scale integration.

Magnetic tape (Magtape): Magnetic tape used as mass storage media and packaged on reels. Since the data stored on magnetic tape can only be accessed serially, it is not practical for use with personal computers. It is often used as a back up device on larger computer systems.

Mainframe: A computer that is physically large and provides the capability to perform applications requiring large amounts of data (e.g., for large-scale payroll system). These computers are much more expensive than microcomputers or minicomputers.

Main memory: See memory.

Mass storage: A device like a disk or magtape that can store large amounts of data readily accessible to the central processing unit.

Mbyte (MB): 1,048,576 (10^{20}) bytes.

Medium: The physical substance upon which data is recorded, for example, magnetic disks, magnetic tape or punched cards.

Memory: (1) The main high-speed storage area in a computer where instructions for a program being run are temporarily kept. (2) A device in which data can be stored and from which it can later be retrieved.

Menu: A displayed list of options from which the user selects an action to be performed by typing a letter or by positioning the cursor.

Menu-driven: A computer system that primarily uses menus for its user interface rather than a command language.

Microcomputer: A computer which is physically very small — it can fit on or under a desk — and which is based on large-scale integration (LSI) circuitry. It is usually the least expensive of the computer types.

Microprocessor: A single-chip central processing unit incorporating LSI technology.

Migration path: A series of alternatives outlined by a computer manufacturer that enables you to introduce new computer equipment into your present system. It permits you to increase your system's computing power by adding or trading in components, rather than giving up all your current hardware and software.

Minicomputer: A type of computer whose physical size is usually smaller

than a mainframe. In general, its performance exceeds that of a microcomputer. Since minicomputers are more modular than mainframes, they can be configured to provide better price/performance systems.

Mnemonic: A short, easy-to-remember name or abbreviation. Many commands in programming languages are mnemonics.

Modem (Modulator/Demodulator): A device that converts computer signals (data) into high-frequency communications signals, and vice versa. These high-frequency signals can then be sent over telephone lines.

Monitor (hardware): A television-like device that can be used as an output display. See also cathode-ray tube and display screen.

Monitor (software): Part of the operating system that allows the user to enter programs and data into memory and run programs.

MOS: Metal-oxide semiconductor, the most common form of LSI technology.

Multi-copy form: A preprinted, multiple form that contains carbon paper between the pages (e.g., tax forms and credit card receipts).

Multi-key sort: Using more than one parameter to qualify a record for inclusion in a specified group or to order a set of records.

Multi-processing: Execution of two or more computer programs by a computer than contains more than one central processor.

Multi-programming: A scheduling technique that allows more than one job to be in an executable state at any one time. Thus, even with one CPU, more than one program can appear to be running at a time because the CPU is giving small slices of its time to each executable program. See multi-tasking.

Multi-tasking: The execution of several tasks "at the same time" without having to complete one before starting another. Although computers can perform only one task at a time, the speed at which a computer operates is so fast that it appears as though several tasks are being performed simultaneously. See multi-programming.

Network: A group of computers that are connected to each other by communications lines to share information and resources. See computer network.

Nonvolatile memory: Memory that does not lose its contents when a processor's power supply is shut off or disrupted.

On-line: Directly under the control of the computer; data is introduced into the CPU immediately.

Operating system: A collection of computer programs that controls the overall operation of a computer and performs such tasks as assigning places in memory to programs and data, processing interrupts, scheduling jobs and controlling the overall input/output of the system.

Option module: An add-on printed-circuit module that allows expansion of a system. See board.

Parallel transmission: Sending more than one bit at a time. See serial transmission.

Parity: A one-extra-bit code used to detect recording or transmission errors by

making the total number of "1" bits in a unit of data — including the parity bit itself — odd or even.

Peripheral: A device that is external to the CPU and main memory, e.g., printer, modem, or terminal but connected to it by appropriate electrical connections.

Pixels (Picture elements): Definable locations on a display screen that are used to form images on the screen. For graphics displays, screens with more pixels generally provide higher resolution. See bit-map graphics.

Port: A physical area for the connection of a communications line. This line can be between the CPU and anything external to it, such as a printer, another computer, a modem, or another communications line.

Power supply: A transistor switch that converts ac power into dc power; energises components such as integrated circuits, monitors and keyboards; and steps down the power supplied to some components.

Primary memory: See main memory.

Printer: The device that produces a paper copy of a document (hard copy output). There are two types: draft-quality and letter-quality printers. Unlike a terminal, there is virtually no communication from printer to CPU.

Printhead: The element in a printer that forms a printed character.

Printwheel: See daisywheel.

Printout: An informal expression referring to almost anything printed by a computer peripheral device; any computer-generated hard copy.

Processor: The functional part of the computer system that reads, interprets, and executes instructions. See central processing unit.

Program: The complete sequence of instructions and routines needed to solve a problem or to execute directions in a computer.

Program disk: A disk containing the instructions of a program.

Programming language: The words, mnemonics and/or symbols, along with the specific rules allowed in constructing computer programs. Some examples are BASIC, which is used on DIGITAL's personal computers, FORTRAN and COBOL.

RAM: (Random Access Memory) Memory that can both be read and written into (i.e., altered) during normal operation. RAM is the type of memory used in most computers to store the instructions of programs currently being run.

Realtime: Taking place during the actual occurrence of an event. It refers to computer systems or programs that perform a computation during the actual time that a related physical process transpires in order that the results of the computation can be recorded or used to guide the physical process, e.g., computers that guide airplane landings.

Record: A collection of related data items.

ReGIS: (Remote Graphics Instruction Set) DIGITAL's graphics command interface to terminals for putting shapes on the terminal screen. DIGITAL's VT125 terminal contains a ReGIS interpreter.

Remote: Not hard-wired; communicating via switched lines such as

telephone lines. Usually refers to peripheral devices (e.g., printers, video terminals) that are located at a site away from the CPU.

Reverse video: A feature on a display unit that produces the opposite combination of characters and background from that which is usually employed, i.e. white characters on a black screen, if having black characters on a white screen is normal.

ROM: (Read Only Memory) Memory containing fixed data or instructions that is permanently loaded during the manufacturing process. A computer can use the data in the ROM but cannot change it.

Screen: (1) The display surface of a video monitor. (2) The pattern or information displayed on the screen.

Self-test: A procedure whereby a program or peripheral checks its own operation.

Sequential access: Refers to devices, like magnetic tape, from which data or instructions can be retrieved only by passing through all locations between the one currently being accessed and the desired one.

Serial access: See sequential access.

Serial transmission: Sending one bit at a time. See parallel transmission.

Single-density: Describes the normal recording density for diskettes. For example, on an eight-inch disk 250,000 bytes can be stored.

Single-sided: Describes recording on only one side of a diskette.

Single-thread: Refers to a simple operating system that executes any given task from beginning to end without interruption, as opposed to a multi-tasking system.

Softcopy: Alphanumeric or graphical data (or both) presented in nonpermanent form, such as on a video screen.

Software: The tasks or programs that makes the computer perform a particular function.

Sort: Rearranging the records in a file so that the order is convenient to the user.

Storage unit: A place where documents can be saved for later use, usually a disk or diskette.

System: A combination of software and hardware that performs specific processing operations.

System board: The main module (sometimes called a mother board) in DIGITAL's personal computer system board. It contains the CPU; memory; and the interface circuitry for the keyboard, a printer port and a communications port.

System unit: Box that houses the system board, disk drives, power supply, and option modules.

Tape: A recording media for data or computer programs. Tape can be in permanent form, such as perforated paper tape. Generally, tape is used as a mass storage medium in magnetic form and has a far higher storage capacity than disk storage but it takes much longer to write or recover data from tape than from a disk.

Task: A program in execution.

Terminal: An input/output device used to enter data into a computer and record the output. Terminals are divided into two categories: hard copy (e.g., printers) and soft copy (e.g., video terminals).

Terminal emulation: A communication method in which a terminal acts as a terminal of a different design so that it can be used on various systems.

Timesharing: Providing service to many users by working on each one's task part of the time.

TMS: (Telephone Management System) An option provided by DIGITAL's Professional 350 personal computer that handles making telephone connections and other activities associated with using your personal computer with telephone lines.

Toolkit: The software and hardware components, including documentation, sold by DIGITAL to help software developers create application programs that can be fully integrated into DIGITAL's Professional 350 and 325 personal computers.

Track: The portion of a moving storage medium, such as a disk or tape, that is accessible to a given read/write head position.

Tractorfeed: An attachment used to move paper through a printer. The roller that moves the paper has sprockets on each end that fit into the fanfold paper's matching pattern of holes.

Turnkey system: A computer that is ready to be used without adding any hardware or software; it is complete as packaged for a particular application..

Typeface: See font.

Upgrade: To expand your personal computer as new features are developed or as existing features are enhanced.

User-defined key (UDK): A key that remembers and stores a series of key-strokes, allows the user to save keystrokes needed to perform a specific operation, and then initiate them in the proper sequence by pressing only one key.

Video monitor: See monitor (hardware).

Video terminal: A terminal that displays data on a CRT.

Volatile memory: Memory that loses its contents when power is removed unless battery back up is available. See core and non-volatile memory.

VT: Video terminal. The common trademarked name of DIGITAL's VT100 family of video terminals.

Winchester disk: A hard disk permanently sealed in a drive unit to prevent contaminants from affecting the read/write head; this virtually eliminates the need for adjustment of the head by field service personnel. The disk is capable of storing larger amounts of data than a diskette.

Word: The greatest number of bits a computer is capable of handling in any one operation. Usually subdivided into bytes.

Word processing system: A system that processes text, performing such

functions as paragraphing, paging, left and right justification, rearrangement of lines and printing the text.

Word-wrapping: The automatic shifting of words from a line that is too long to the next line.

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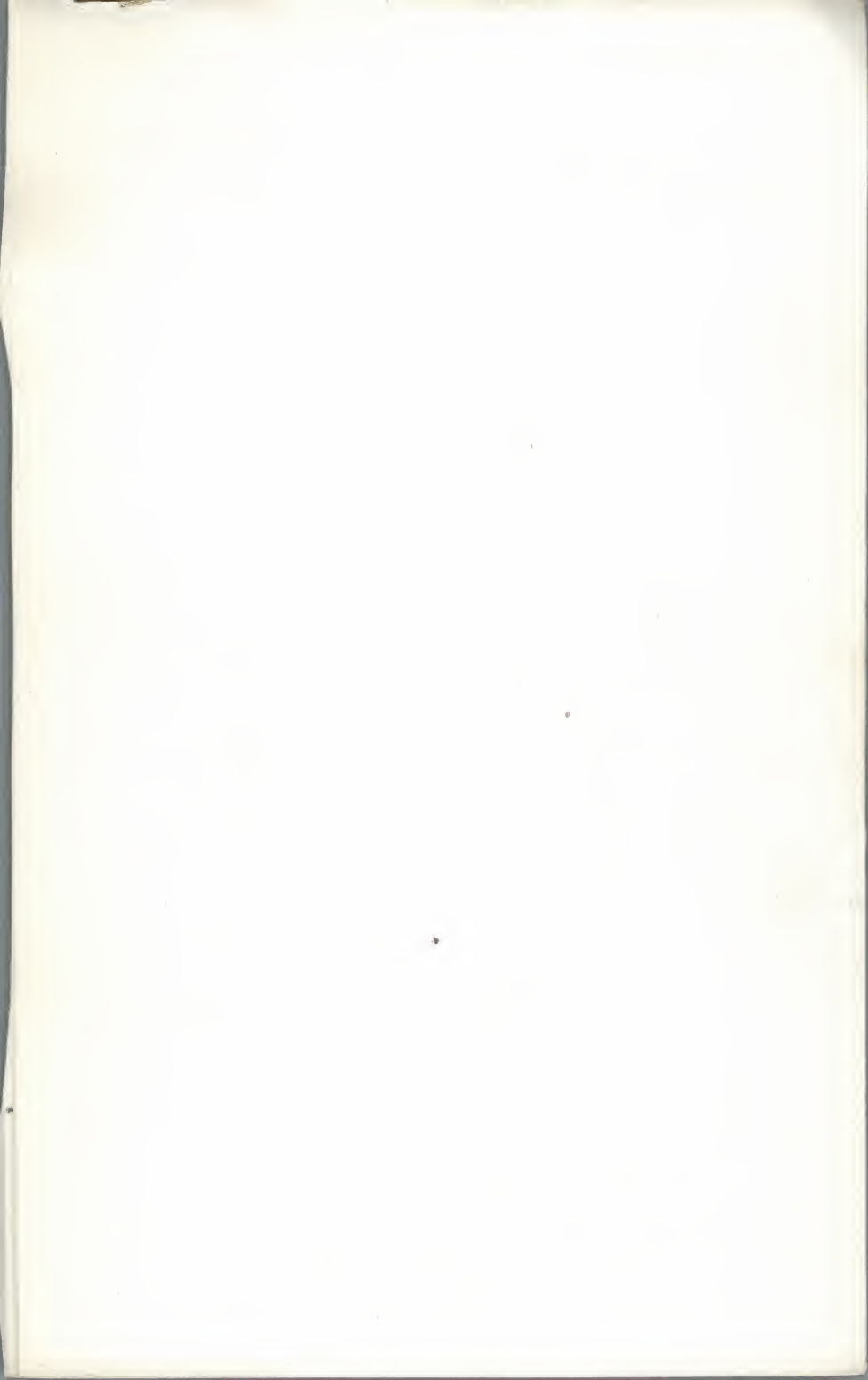
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